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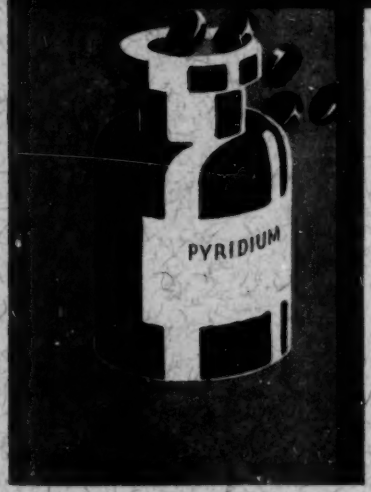

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ANNALS *of* SURGERY

Vol. XCV FEBRUARY, 1932 No. 2

ACUTE FRACTURES OF THE PELVIS*

BASED ON EIGHTY-ONE COLLECTED CASES

By William R. Gilmour, M.D.

of Philadelphia, Pa.

This paper is based on eighty-one cases of fractures of the pelvis. They were of various types caused by all sorts of accidents, a motor-driven vehicle being the most frequent offender. Other major causes were severe crushes and falls from considerable heights. The fractures may be tabulated by an anatomical classification as follows:

Fractures of the ilium	20
Superior ramus of the pubis	13
Inferior ramus of the pubis	23
Superior ramus of the ischium	18
Inferior ramus of the ischium	8
Acetabular fractures	8
Separation of the symphysis pubis	9
Definite sacro-iliac separation	7
Isolated fracture of the anterior superior spine	1
Double vertical fracture of the pelvis (Malgaigne)	8
Fracture of the sacrum with associated pelvic fracture	4
Fracture of the coccyx	3

These cases were collected from the ward records of three general hospitals of this city, the Methodist Episcopal, the Northeastern, and the Philadelphia General, for the period from January, 1920 to January, 1929. The ages range from three to seventy-four years with forty of the cases occurring between the thirtieth and fiftieth years. The period of hospitalization averaged three weeks in simple complicated fractures of the ilium and the anterior ring without displacement. The time for the posterior girdle fractures and double vertical fractures averaged seventy days. Cases complicated with a fracture of the femur and visceral injury were hospitalized for periods ranging from five to nine months.

There were in this series twenty females and sixty-one males. Of the eighty-one cases, twenty-three occurred in industrial hazards and fifty-two in automobile and street accidents.

There were seventeen falls varying from a fall of forty-five feet by a steeple-jack, on concrete, to a case of an old lady tripping over a carpet in her home. Severe crushes by machinery, falling walls or heavy objects were found in twelve cases.

Before considering these fractures in classified groups it will be interesting to observe a few points of the bony pelvis, since it is obvious that when

* Read before the Philadelphia Academy of Surgery, October 5, 1931.

direct trauma is applied to this region the weakest parts are mainly affected. The posterior half of the bony framework of the pelvis is subject to greater stresses and strains imposed upon it by body weight and muscle traction and is consequently much stronger than the anterior half which is comparatively weak. The symphysis pubis, the integrity of which depends mainly upon the sub-pubic and the supra-pubic ligaments cannot be regarded as a strong joint and trauma may cause dislocation of the symphysis instead of fracture of the pubic rami. Traumatic dislocation of the sacro-iliac joint, on the other hand, in the absence of disease of the joint, is almost unknown. Posterior sacro-iliac ligaments are some of the strongest if not the strongest ligaments found in the human body. Wakeling states further that the acetabulum might be regarded as one of the weak spots in the pelvic girdle, but this is far from being the case. It has been noted that by far the thickest and strongest part of the bone is a bar which extends from the auricular surface to the acetabulum. He compares this bar to a three-sided pyramid, the apex of which is situated at the upper part of the auricular surface, while its enormously thick base supports the upper part of the acetabulum. This thickened bar of bone obviously enables the hip bone to withstand the great stress of body weight transmitted from the sacrum to the head of the femur in an erect posture. A second but less well-marked thickening is noted extending from the tuberosity of the iliac-crest (prominent boss on the forepart of the iliac crest to which the ilio-tibial band is attached) to the upper part of the acetabulum. If a section is made through the hip bone in a plane corresponding to a line drawn from the upper part of the auricular surface to the acetabulum, it will be seen that the strength of the weight-resisting bar of the bone does not depend alone on the actual thickness of the bone, but also upon a peculiar and remarkable arrangement of the bony material. In the cancellous tissue two sets of pressure lamellæ may be seen diverging from the auricular surface and impinging upon two relatively very thick interjections of the surface compact bone on either side. These interjections are comparable with the calcar femorale, upon which the resistance of the inner side of the neck of the femur is so largely dependent. From them spring two sets of the lamellæ, which converge into the upper part of the acetabulum, where again the compact bone is remarkably thick. There are thus two sets of lamellar arches in cancellous bone interposed between the auricular surface and the acetabulum, inverted as regards one another and supported by buttresses of compact tissue. A more adequate arrangement for resisting stress cannot well be imagined. Certain well-known features of pelvic fracture now become intelligible, owing to the resistance which the bases of the two thickened bars of the hip bone confer upon the upper part of the acetabulum.

Fractures of the acetabulum and especially the upper part of the acetabular lip are of relatively infrequent occurrence. In most cases of fracture of the ilium the lines of fracture do not pass downward and forward from the point of application of the trauma, but invariably stop short in the region of the main bony bar.

For purposes of further discussion this group may be classified as fractures of the ilium, fractures of the anterior arch; fracture involving the acetabulum and double vertical fractures. There were twenty cases of fracture of the ilium, of which fifteen were simple fractures. They were all caused by direct trauma which is the definite mechanism for this fracture. Falls accounted for seven cases, street accidents six, while one was due to muscle pull in a child running in a playground. The anterior superior spine was avulsed in this case. In five cases, the iliac fracture was part of a multiple fracture. Three of these cases died, one of streptococcic infection in the prevesical space of a case of multiple fracture through the anterior ring of the ilium complicated further by a rupture of the bladder, internal hæmorrhage and dislocation of the femur.

A second case, caught in a cave-in, suffered a double vertical fracture involving the right ilium and spreading through the sacro-iliac joint. The fourth and fifth transverse lateral processes of the spine were also broken. An immediate operation was done to drain an extra-peritoneal rupture of the bladder. Death ensued four hours later. A third case, a male, aged fifty years, fell twenty feet one hour before admission to the hospital; he suffered a double vertical fracture including a portion of the right ilium. The bladder was also ruptured in this case and the skull and ribs were fractured. Death occurred three hours after admission. Treatment of the uncomplicated cases consisted of rest in bed with an appropriate pelvic swathe. An average of three weeks was spent in the hospital and their convalescent period occupied on an average the same period. In the simple cases there were no late symptoms and after a few days no pain or discomfort was experienced except in attempting to turn over. The child, who suffered an avulsion of the anterior-superior spine, made an excellent recovery on conservative treatment.

Forty-six cases suffered anterior ring fractures. The mechanism in these fractures is a compression force applied anterior-posteriorly. The accidents by vehicles numbered thirty-two, crushes seven, and falls also seven. There were nine cases of rupture of the bladder in the entire series; seven fell in this group. The urethra was ruptured on two occasions; marked extravasation of the bladder into the perineum and scrotum was mentioned twice. Thirty times blood per urethram or blood-tinged urine was noted in the history. Three of these six cases of ruptured bladder died; one was unoperated. Ten days after admission perineal swelling was noted in this last-mentioned case and pus was evacuated. The condition became progressively worse and at autopsy a small rent was found in the anterior portion of the bladder near its neck. Two cases made recovery after proper drainage and two died shortly after operation from shock. There was definite displacement of fragments in eighteen cases of this group, the majority of which showed improvement upon reëxamination after simple appropriate conservative treatment had been applied. Uncomplicated cases made rather excellent recovery but the convalescent period was a little longer than in the iliac fractures.

There were eight cases of acetabular fracture; three were simple chips, which united perfectly without any pain or displacement. As in Severs' cases, several of these so-called acetabular dislocations have come to the hospital weeks after injury. Cottalorda[4] has experimented on several cadavera, using the force applied through the trochanter. He believes that a fracture of the acetabulum may be produced by a relatively slight blow or fall when applied in the right direction. Our case histories (five cases) are in agreement with this finding. There were no deaths in this group.

The double vertical fractures are the product of the more severe traumatic forces. The degree of dislocation in the pelvis was marked in some of the cases. The cases in this group with sacral involvement were due to severe local violence. Traction on the leg, combined with a pelvic sling, was necessary in several of these patients with the fracture extending through the pubic arch, the sacro-iliac joint and the wing of the ilium, on the same side, with a dislocation upward on that side of the pelvis. There was no peroneal nerve involvement noticed in these cases as described by G. G. Davis. However, some temporary partial weakness was noted in some of these cases for a considerable period of time. The period of hospital stay was the longest in this group for uncomplicated cases. The greatest degree of permanent disability was noted in these last two groups.

Complications.—Twenty-two cases of this whole series were complicated by fractures in other regions. The shaft of the femur was the commonest site for these associated fractures. One case in this group developed gas gangrene and amputation of the leg was followed by an ultimate recovery. There were nine cases of rupture of the bladder, eight extra-peritoneal and one intra-peritoneal. There were three recoveries in the extra-peritoneal group, and two ruptures in the urethra which were drained and recovered. The perineum was badly lacerated in two cases, with wide tears of the vagina also. There was one case of rupture of the small intestine and one case of rupture of the sigmoid flexure. There were eight deaths in this series. Six died on the day of admission; five of these were operated on for ruptured viscera and internal hæmorrhage. One case died of nephritic complications during the fourth week and one unoperated case died on the eleventh day. At necropsy a small rent was found in the anterior portion of the bladder, near the neck.

The heaviest responsibility in the management of these cases is to truly recognize and treat at the earliest moment effectively, the injuries to the internal viscera. A certain degree of judgment is necessary to determine the presence or absence of a rupture of the bladder and severe injury to the deep urethra, internal hæmorrhage and rent gut. In gross rupture of the bladder intra-peritoneally, the bladder will be empty and nothing will be secured by catheter except possibly blood. In extra-peritoneal ruptures of the bladder, bloody urine is generally present, but within a short time there is apt to be a definite presence of supra-pubic or perineal extravasation of both blood and urine. In those cases in which there is a tear of the deep urethra the passage of a catheter is either difficult or impossible and such instrumenta-

tion should be done with the greatest care as it is possible to do great harm even in minor lacerations of the urethra. If intra-peritoneal rupture of the bladder is suspected, immediate laparotomy should be performed as soon as the condition of the patient will allow and if rupture is discovered, closure by suture should be done followed by intra-peritoneal drainage. If the rupture proves to be extra-peritoneal and in such location as to allow suture, closure is done, but if exposure is difficult, simple drainage of the bladder and prevesical space is sufficient, supplemented by drainage by the urethra. Those cases showing gross lesions of the urethra in men are treated by immediate perineal urethrotomy. If the urethra is completely divided an attempt is made at union, which, however, is not always possible; but if care should be taken, most excellent results can be secured. As simple as these rules are, diagnosis is difficult. Rupture of the bladder, as a whole, is a comparatively rare incidence, but in collected series of fracture of the pelvis, it occurs once in every seven cases.

Campbell[7] in a recent paper studied fifty-five cases of bladder rupture; twenty-one were extra-peritoneal and thirty-four were intra-peritoneal. Ten were not operated upon. Forty-five cases were operated on in this series with a total operative mortality of 55 per cent. The total mortality for the whole group was 63.6 per cent.

The writers in reviews of pelvic fracture repeatedly state that these fractures are not as rare as formerly supposed and that accidents caused by the ever-increasing street traffic are year by year making the fractures more frequent. In 1924 Hirsch[2] stated that fractures of the pelvis constituted from .3 to 1 per cent. of all fractures in general. Walker, in discussing Noland's and Conwell's recent paper, stated that 900 fractures were reviewed in the records of the Massachusetts General Hospital for the five-year period 1925 to 1930. There were thirty fractures of the pelvis, which is still .3 per cent. incidence. As early as 1908 Ashhurst[1] collected fifty-seven cases of fractures of the pelvis from the records of the Episcopal Hospital in this city for tne period from 1895 to 1908. There were eighteen deaths with a mortality of 31.57 per cent. Of these eighteen fatal cases there were no visceral complications in eight, deaths in most of these being due to other injuries (crushes of the extremities, fractured skulls, *etc.*). Ten cases in the group complicated by visceral injury, are listed as follows:

Rupture of the urethra	4 Cases—Recovery, 1;	deaths, 3
Extra-peritoneal rupture of the bladder	4 Cases—Recovery, 1;	deaths, 3
Rupture of undiscovered portion of the Genito-Urinary Tract	1 Case—Recovery, 0;	deaths, 1
Rupture of the liver	1 Case—Recovery, 0;	deaths, 1

In 1923, Orator[3] reported the end-results of fractures of the pelvis in seventy cases collected at the Van Eiselberg Clinic of Vienna for the period from 1901 to 1920. There were fourteen deaths, a mortality percentage of 20 per cent. Anterior circular fractures and marginal fractures make up 80 per cent. of the total; acetabular 5 per cent.; posterior circular Malgaigne

fractures 25 to 30 per cent.; in 29 per cent. of the cases the results were good and 22 per cent. of the results were poor.

In 1928, Sever reported fifty-one cases with one death. No mention is made in his text of visceral injury in any of the living cases. He tabulates his results as good in twenty-four cases, poor in ten and unknown in sixteen. This paper has been followed by reviews in the past two years by Wakeley, Culp and Findlay, Harding, Noland and Conwell.

Wakeley[6] in a series of one hundred cases treated by him during the 1913–1928 period found that there were visceral complications in only eleven. The small number of cases in which visceral complications occur is not really so surprising as appears at first sight when it is considered that quite a large proportion—due to their being run-over cases where the pelvis is fractured and multiple visceral injuries are found at autopsy—are immediately fatal. He makes no mention of mortality rate. Culp and Findlay[5] report excellent results in twenty-one of their thirty-five consecutive cases. There were three cases of rupture of the bladder, one with extravasation of urine, rupture of the urethra in two cases, and temporary paralysis of the bladder in one case. Other complications included punctured pleuræ, traumatic pneumothorax, cerebral concussion, ruptured jejunum and general peritonitis. Forty-eight per cent. of the cases were complicated by additional fractures in other regions. These complications demonstrate the enormous amount of injury suffered by patients and show the important rôle that fracture of the pelvis plays in traumatic injury. Fatal cases numbered six—17.1 per cent. Harding divides one hundred and twenty-seven cases to a number of groups, placing the greatest number in a general multiple pelvic ring class. There were ten deaths in his series. Five bladder ruptures were encountered with three deaths and one ruptured urethra with recovery. He offers a standardized form of treatment for pelvic fracture in his paper.

Noland and Conwell,[8] in a recent paper, also present a standardized treatment and give results in one hundred and twenty-five acute cases treated in their wards from January, 1920, to July, 1928. Sixty cases showed blood in the urine, twenty-two had sustained rupture of the bladder; nine had either severe laceration or complete division of the deep urethra. There were a total of twenty deaths in this series, a 16 per cent. mortality rate. Fourteen, all of whom had severe associated injuries which were regarded as necessarily fatal, died within twenty-four hours following admission.

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HEMIPELVECTOMY*

By Kellogg Speed M.D.
of Chicago, Ill.

This title may be misleading but is used in place of the more cumbersome description, inter-ilio-abdominal amputation. The two cases here reported included amputation of the leg and were not simply local resection of part or half the pelvic ring.

In surgical experience there is met an occasional instance of extensive disease of the proximal thigh extending toward the pelvis or into the pelvic bones, which if radically removed may promise the patient freedom from further extension and give prolongation of life. In my brief surgical career this condition has been met at least six times and in two of them I have operated for radical removal or inter-ilio-abdominal amputation. Both patients failed to survive. Babcock[5] mentions five inter-ilio-abdominal amputations with three deaths.

The indications are:

(1) Extensive disease of the proximal thigh where hip disarticulation will not suffice for complete eradication of the disease. This may be malignant or benign.

(*a*) Bone tumors involving the proximal end of the femur extending into the soft parts or the pelvic bones or hip-joint and toward the pelvic cavity.

(*b*) Chronic bone infections in the same locality not yielding to surgical drainage.

(*c*) Malignant tumors or infections of the soft parts of the hip area extending into the bones of the pelvis or buttock tissues.

(2) Malignant bone tumors of the ilium and tumors of the soft parts of the outer surface of the pelvis extending into the hip-joint and femur or into the soft parts too extensively to yield to local resection of part of the bony pelvis but which require as well removal of the whole limb.

(3) Extensive dissecting aneurisms of the femoral artery.

(4) Crushing injuries of the hip region with gas infections.

Certain rules should be abided by in choosing this radical procedure after the customary complete physical examination of the patient. If the indication is malignant (bone) tumor there must be careful search for regional or distal metastases, especially in the lungs and thorax. The disease should not have penetrated through the iliacus muscle into the pelvis proper nor beyond the boundaries of the sacroiliac and symphysis pubis joints. A thoroughly searching röntgenological examination of the pelvis, femur, lower spine and chest is required to settle these points.

The patient should be at least a reasonable risk for this most extensive

* Read before the Western Surgical Association, December 4, 1931.

operation and should understand the nature of it so that he is willing to take the chance of loss of life in exchange for the attempt at freedom from the disease or the pain he suffers. Every possible effort at preparation of the patient should be made. Some time may be taken for hyperalimentation. Body fluids should be increased to the maximum, short of cardiac embarrassment or œdema; the heart should be digitalized.

The technic of operation may be briefly given as follows: Differences of incision or even avenue of approach may be required on account of the size or situation of the tumor mass or the abnormal position of the limb from contracture at the hip. After the patient is placed on the table the blood in the limb to be removed may be partly drained back into the general circulation as a means of auto-transfusion by the application of a Martin bandage from ankle to hip, provided there is no real danger of driving in infections or metastases. The patient is placed in the lateral semiprone position lying on the well side, one assistant holding the wrapped limb which is to be removed. The incision starts at the iliac crest a short distance in front of the posterior superior spine of the ilium, passing forward along the iliac crest past the anterior superior spine down along the superior pubic ramus not quite to the symphysis so that the spermatic cord will not be endangered. This incision is deepened rapidly to the ilium, the abdominal muscles are cut free from their insertion at the iliac crest, the edge of the iliacus muscle is rapidly exposed by pushing back the reflected abdominal wall and peritoneum. The superficial and inferior epigastric and circumflex iliac vessels are here encountered, are clamped and tied. The iliacus is then freed from its origin on the inside of the ala of the ilium and is reflected back with the peritoneum and abdominal mass. The dissection rapidly passes forward until the great vessels coming across the pubic spine are encountered. They are exposed, clamped, ligated. Any suspicious lymph-nodes can then be resected as high as is required along the course of the iliac vessels.

The spermatic cord is pushed back and the dissection hugs the pubic ramus until the symphysis is reached. This is easily cut through with a scalpel unless it is completely ossified. By springing the side of the pelvis outward the incision is directed down and backward, keeping well away from scrotum and anus to curve around the thigh at the level required, usually well below the gluteal crease. By cutting off the thigh adductors close to the pubis one may then expose the inferior ramus of the pubis. The psoas muscle with the converging portion of the iliacus is encountered and severed between clamps.

The operator then returns to the site of the start of the incision and extends it downward and backward near the sacroiliac joint, curving down the buttock to meet the anterior angle of the circular incision where it crosses under the upper thigh.

By cutting through the sacroiliac joint, the whole half of the pelvis, exclusive of the sacrum, can then be mobilized, and the dissection is carried through the gluteal mass of muscles, picking up vessels as they are encountered. By clinging closely to the ischial rami the tuberosity may be dissected out almost bloodlessly, the sciatic nerve being encountered, injected and cut off high at this time. The half pelvis and attached leg are thus removed. An ample flap remains. Vessels are tied; any additional removal of pathological tissue follows, and the gluteal flap is then turned upward and inward for attachment first by fascial and muscular stitch to the abdominal muscles and then by interrupted skin stitches. A tubal drain may be used.

This method of procedure involves a minimum danger to the peritoneum and bladder both of which are pushed away from the bony structures by rapid dissection. The male patient need not suffer castration because the careful reflecting dissection in no way endangers the scrotum and testis.

For fear of spreading the disease or infection, opening the hip-joint seems unwise and would prolong the operation, add to the shock. The major nerves, especially the sciatic, should be injected with novocaine and alcohol before resection.

The two instances of operation here reported have been performed under different anæsthesia. In the first operation straight ether by the open method was used, accompanied by simultaneous intravenous administration of normal salt solution. Cardiac and respiratory stimulants were also given. The second operation was performed under spinal anæsthesia aided by pressor drugs such as ephedrin, digalin, *etc.*, with two ounces of ether by the rebreathing method employed as an adjunct.

The amount of blood loss in the operative field was not startling in either instance. Just how much cannot be stated. The amount of blood lost in the amputated limb was, however, considerable. Great nerve trunk injection

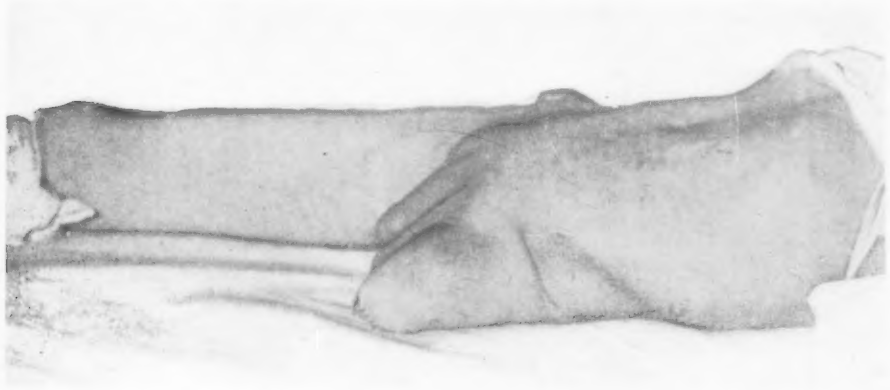

FIG. 1.—First patient just after operation, showing character of flap covering hemipelvectomy stump.

with novocaine before severance may spare shock. This point could not be decided on after such a small amount of observation. During war service I performed under spinal anæsthesia with no immediate post-operative mortality thirty or more thigh amputations in soldiers suffering from extreme sepsis. Until this case I have not employed this anæsthetic method in civil practice.

CASE I.—A. B., male, fifty-nine years old, admitted to the Cook County Hospital August 3, 1931. No. 1244689. He had been in the hospital before and returned on account of intractable pain for which he was willing to undergo any procedure which might offer relief, even at the possible expense of loss of life. The examination revealed rather a poorly nourished man, evidently in distress from pain in the left side of the pelvis. A hard, fixed tumor mass involving the left ilium extending into the buttock and back toward or into the sacroiliac joint was seen. This tumor did not fluctuate, was not painful to pressure. There was much pain referred along the sciatic distribution for which sedatives were constantly required. In the thigh there was atrophy of disuse. X-ray examination revealed a bone tumor in the ilium with some evidence of bone thickening absorption and new bone formation extending from the acetabulum to the sacroiliac joint. The femur was apparently not involved. The chest showed no X-ray

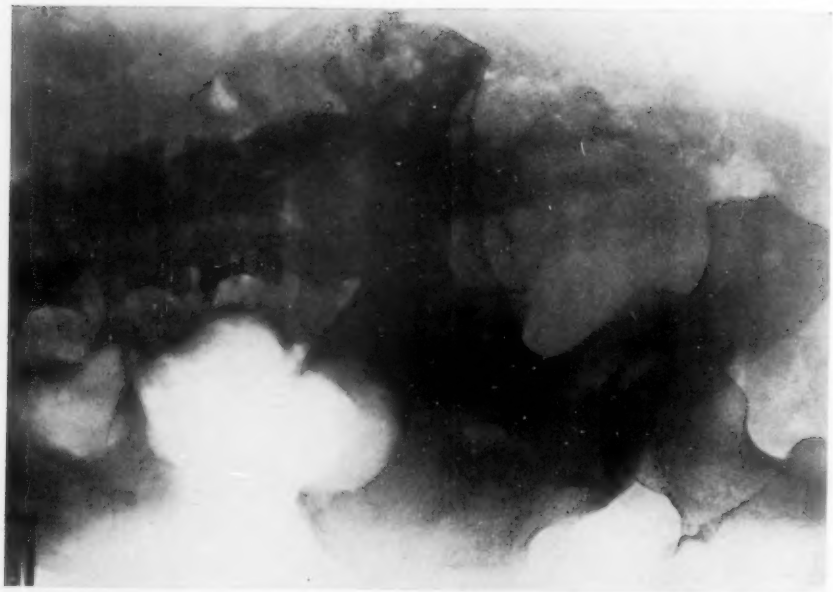

FIG. 3.—Post-operative X-ray of the first patient, showing the loss of the pelvic bones from symphysis pubis to sacroiliac joint.

FIG. 2.—X-ray film of specimen removed from first patient. The extent of the involvement of the ilium and the hip region by the osteogenic sarcoma is shown along with the surgical separation of the intact pelvis at the pubic and sacroiliac joints.

abnormality. No metastases were clinically demonstrable, and the blood gave a negative Wassermann reaction.

Operation for removal of half the pelvis plus the whole leg followed on September 11, 1931. The tumor mass occupied the left gluteal region as far back as the posterior superior iliac spine, swelling out about the size of a grapefruit. A preliminary incision into the tumor for biopsy was made. It was found to infiltrate into the gluteus maximus muscle, was extremely vascular and apparently bone forming. Much hæmorrhage was started up by the biopsy; this was controlled by suturing the wound at once and closing the skin. The patient was redraped and put on his right side in the Sims lateral position so that the operation might proceed. A report on the frozen section confirmed the diagnosis of osteogenic sarcoma. The hemipelvectomy was performed. The time of operation including the biopsy was one hour and ten minutes. The patient passed away just after the stump was sutured.

A post-mortem examination gave the following information: (1) Tumor thrombosis of a sacral vein. (2) Multiple minute metastases of the pleura of both lungs and parietal pleura on left side. (3) Slight hypertrophy of the heart with dilatation of the left ventricle; myocardial degeneration. (4) Anæmia of liver and kidneys. (5) Atrophy and softening with hemosiderosis of the spleen. (6) Diffuse colloid goitre.

Abdominal Cavity.—Bladder 9 centimetres above the symphysis, intact. The peritoneum throughout the entire abdominal cavity was intact, pale, smooth and shiny. The liver was 1.5 centimetres below the xiphoid and costal margin. Each pleural cavity contained a small amount of clear fluid, and the pericardial sac held about 100 cubic centimetres of the same.

The heart weighed 380 grams, was soft and flabby. Left valve 18 millimetres, right valve 4 millimetres. The myocardium was pale brown and quite friable. The left valve was much dilated, and the papillæ were flattened. The interior of the aorta was smooth and there were small plaques about the valves. The coronary arteries were thin-walled and had a smooth interior.

The lungs were crepitant, distended. The pleura was shiny with numerous pinpoint to 5-millimetre, slightly raised and moderately firm grayish plaques. In the left lower lobe of the lung was a single pinkish-gray nodule 2 millimetres in diameter. Lymph-nodes at the hilum and bifurcation were small and anthracolic. A similar group of plaques existed on the diaphragmatic dome, covered by the pleura and extending into the intercostal muscles.

The thyroid weighed 60 grams, was diffusely enlarged, uniformly granular, pale purplish-gray.

The left half of the pelvis was missing. The large veins and arteries of the pelvic region were intact. There was very little hæmorrhage around the large defect caused by the removal of the bone. Rectum normal, intact. On the left side of the sacrum a vein 1 millimetre in diameter presented a lumen filled with soft, pink-grayish nodules as large as 7 by 5 by 3 millimetres. There were also pinkish lymph-nodes here up to 20 millimetres in diameter.

Case II.—C. W., male, forty-five years old, admitted to the Cook County Hospital May 27, 1931. No. 1223070. He complains of pain in the left leg but was quite well until early in 1930 when he began to experience constant shooting pain in the left hip and leg down to the heel without known cause. Has had a little headache and dizziness and is unable to walk. Strength in his left leg, which is atrophic and held in a partly flexed position at the hip, is greatly diminished. Deep patellar and other reflexes were normal. There was shortening of about 1 inch in the left leg and marked tenderness to motion and palpation at the left hip. Here had formed a diffuse, hard, bony mass evidently involving both femur and ilium. Urine normal; blood Wassermann negative. The röntgenological examination showed an irregular area of sclerosis and absorption with some new bone formation in the proximal portion of the left femur extending into

the acetabulum and ilium. There was also a fracture below the neck of the left femur with change of the neck angle and coxa vara. Examination of the chest and lumbar spine showed nothing abnormal. A diagnosis of osteogenic sarcoma of the femur and ilium with pathological fracture of the neck of the femur was made.

FIG. 4.—Gross section through the osteogenic sarcoma of first patient, showing involvement of ilium and extension down around hip structures.

Operation was performed October 19, 1931. The technic used was as outlined. Spinal anæsthesia was induced by the injection of 3 cubic centimetres of spinocaine after 3 cubic centimetres of spinal fluid was withdrawn, the operation starting twenty-five minutes later. Two ounces of ether were required to give complete analgesia at the start, no more being used later. The patient was placed on the table with his head down 15 degrees from horizontal and this position was maintained.

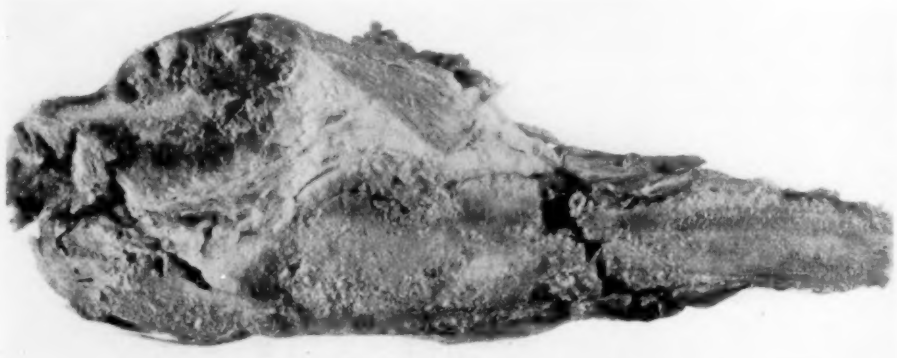

FIG. 5.—Gross section through the osteogenic sarcoma of the second patient, showing involvement of the ilium, hip-joint, and pathological fracture of the subtrochanteric portion of the shaft of the femur.

The blood pressure readings were as follows:

10:20 A.M.	136/84	before anæsthesia.
10:45 A.M.	134/80	operation began.
11:25 A.M.	126/78	operation ended.

Ninety milligrams of ephedrin hydrochloride were given when the spinal anæsthesia was started. At 11:10 A.M. caffeine sodium benzoate 7.5 grains and digalin 15 minims were given . At 11:25 A.M. 15 minims of adrenalin were administered. Hypodermoclysis

was administered during the operation so that by 11:55 A.M. he had received 3,000 cubic centimetres. At this time he was given more caffeine sodium benzoate 15 minims and strychnine sulphate grain 1/30. At 12:50 P.M. he had adrenalin 20 minims and caffeine sodium benzoate 10 grains but passed away within an hour, the pulse varying between 144 at 11:45 A.M. and 132 at 12:10 P.M.; respiration remaining at 40 with no cyanosis. Operative time forty-two minutes. The pathological report of the tumor was osteogenic sarcoma. An autopsy was refused.

The literature on hemipelvectomy is rather meagre, especially on real inter-ilio-abdominal amputation. Billroth in 1891 described such an operation and Jaboulay[4] in 1894 gave a terse description of the technic and indications without mention of the number of patients operated upon. At the German Surgical Congress in 1914 Napalkow[2] said that Von Bergmann was able to collect but thirty-eight instances of pelvic resection, the first being performed in 1885 to which he added an additional case which had a good result with outward rotation of the leg, no amputation of the extremity being done. In 1930 Patel reported a case of removal of a cartilaginous tumor weighing 1,600 grams including part of the pelvis. The patient was able to walk thirty days later. In the discussion of Patel's[3] report Durand cited a similar case.

König's[1] article cites with his own, other interesting cases operated upon by Köcher 1884, Trendelenburg 1899, and Walzel 1924, for osteochondroma. Most of these patients were able to walk after pelvic resection.

Complete inter-ilio-abdominal amputation, however, seems rare. This extensive and dangerous procedure must be reserved for the extreme case, with an understanding of its feasibility but also of its great mortality. Possibly better methods of combating shock or some combination of anæsthesia may lower the operative mortality and permit surgical relief to be offered to the apparently hopeless situations touched upon in the indications for this amputation.

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CONGENITAL HYPERTROPHIC PYLORIC STENOSIS IN INFANCY*

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Congenital hypertrophic pyloric stenosis is one of the most important surgical conditions encountered in early infancy, and, if treated after proper preparation by the Fredet-Rammstedt operation, it can be permanently and easily cured. There are still some who feel that a complete cure can be effected without surgery, but in our hands the various forms of medical treatment such as atropine, thick feeding or refeeding after vomiting have not been successful.

In this study of 119 consecutive cases operated upon by me at the Babies Hospital, I shall endeavor to point out the advantages of surgical treatment and to advocate it in all instances as soon as the diagnosis is established, except in the few mild cases which respond to medical treatment in a week or ten days. Medical treatment, at its best, is uncertain and prolonged for weeks or months under the strictest supervision with expert nursing. This, from an economic standpoint, is often impractical, and means prolonged hospitalization of an infant, the disadvantages of which we are all aware. It also means taking the baby from the breast, which is not to be advised. Surgical treatment, on the other hand, is quick, certain, permanent in its results and allows nursing to be resumed a few days after operation.

As shown in this series, pyloric stenosis is much more common in male children, 104 of these 119 patients being boys. It is also interesting that seventy-one patients were first children. Fifteen nationalities were represented, with Hebrew children predominating. Two Negro children were included. It may occur in more than one member of a family, one patient operated upon being the ninth boy of a family of twelve children, the first boy of this family having been operated upon successfully for pyloric stenosis by Doctor Downes. The other seven boys showed no evidence of this condition. The mother made the diagnosis in this case.

The etiology of pyloric stenosis has not been definitely determined, but perhaps the most plausible theory is that of a developmental hyperplasia of the circular muscle of the pyloric ring of congenital origin. In support of this theory is the fact that we have had two seven-months premature infants at the Babies Hospital with well-developed tumors. All authorities agree that the essential feature of the pathology is hypertrophy of the circular muscle of the pylorus. The growth of the circular muscle, which may be so great as to almost completely occlude the lumen of the pylorus, forms the tumor which

* Read before the New York Surgical Society, November 11, 1931.

is characteristic of this disease. This tumor is usually about two and one-half centimetres in length, of cartilaginous consistency, stops abruptly at the duodenal end, but merges gradually with the stomach at the gastric end. Because of this almost complete obstruction, the stomach may be four or five times its normal size. It is the spasm of the pylorus accompanying this hypertrophy that causes the symptoms.

The symptoms may date from birth, but this is unusual and makes one think more of a duodenal atresia than pyloric stenosis. The onset of symptoms in this group dated from birth to ten weeks of age. The average age was three weeks. Vomiting, which is always the first symptom, may start abruptly but ordinarily does not. It may follow each feeding and is almost always projectile, the food often being projected several feet. The quantity vomited is small at first but later increases in amount. The vomitus never contains bile, which is an important point in the differentiation of this condition from duodenal atresia. It may, however, contain blood, as it did in four cases of this group. There is always gastric retention, so that the amount vomited at one time may be considerably more than the previous feeding. As a result of this vomiting and loss of nourishment, the patients soon become dehydrated, and, with the rapid loss of weight, they may become emaciated in a comparatively short time. For the same reasons their stools are usually small and dry, and there is a marked decrease in the amount of urine voided.

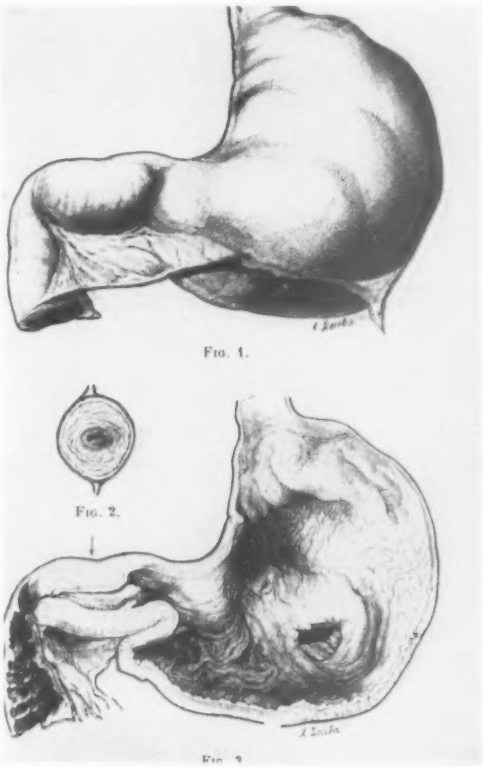

FIG. 1.

FIG. 2.

FIG. 3.

PLATE 1.—Fig. 1.—Stomach of a case of pyloric stenosis, showing the pyloric tumor. Fig. 2.—Cross-section of pyloric tumor, showing narrowed lumen. Fig. 3.—Longitudinal section of pyloric tumor. Note the abrupt change from thick pyloric tumor to thin duodenum.

If the abdomen is watched carefully after a feeding, visible gastric peristaltic waves may be seen in the epigastrium passing from left to right, often in rapid succession. These waves may vary considerably in size and are best seen when the stomach is partially filled. Waves were present in all cases of this series, and, while not pathognomonic of this condition, they are a help in establishing the diagnosis. In addition to the gastric waves, a pyloric tumor may always be felt. It is usually found to the right and above the

umbilicus, and, while it varies considerably in size with the contractions of the pylorus, its feeling has been well compared to that of a small olive. Writers disagree on the importance of feeling the tumor, but I believe it is pathognomonic of this condition and may be felt in every case if a painstaking examination of the abdomen is made. It is not always possible to feel the tumor at the first examination as these children are hypertonic and sufficient relaxation of the abdominal muscles may not be obtained at once. A sugar pacifier is generally sufficient to relax the baby after his stomach has been emptied with a small stomach tube. The tumor was felt in every case of this series before operation, but in three of the 119 cases, no tumor was found at operation. Sometimes the lineæ transversæ of the rectus muscle may be mistaken for a tumor if the abdomen is not well relaxed. I have often found it helpful to press the fundus of the stomach gently toward the right with the left hand while palpating for the tumor with the right hand. The tumor is always best felt when the stomach is empty and is very easy to feel in those infants who have lost considerable weight. It has been suggested that light anæsthesia be used for the abdominal examination, but it has not been employed in this series.

Some authors see distinct advantages in using X-ray or fluoroscope to make the diagnosis, even to the extent of differentiating by this method the cases that should be treated by operation from those in which medical treatment should be used. We have purposely avoided this method of diagnosis because we feel that it is possible to make the diagnosis by other means, having always obtained all the information desired, even to measuring the gastric retention without it.

Pre-operative preparation is perhaps the most important factor in lowering the operative mortality in these patients. When this series was begun, it was customary to operate upon the bad cases as emergencies. As a group, they were the poorest possible surgical risks, and the result was a very high mortality. At that time, the mortality from collapse alone was reported in some series as high as 9 per cent. This high mortality is well illustrated by the fact that six of the seven deaths reported in this group of 119 patients occurred in the first nineteen cases operated upon. There has been but one death in the last 100 cases since we have appreciated the value of pre-operative preparation. We now feel that there is no need to hurry operation upon these children even though they are vomiting everything. If the baby is in particularly bad condition, he is given one or two pre-operative transfusions by the Lindemann method, using twenty cubic centimetres of whole blood for each kilogram of body weight. Sixty-eight patients in this series were transfused once before operation, and five patients received two pre-operative transfusions. All patients received from one to four hypodermoclyses of 100 cubic centimetres of 3 per cent. glucose before operation. It is amazing how easily you may convert a particularly bad surgical risk into a fair one in two or three days by this means. We have had but one death from collapse, and this occurred very early in the series, before prolonged pre-operative

treatment was begun. This child, an exceptionally bad risk, died about ten hours after operation, and at autopsy showed nothing wrong with the operation. I am sure that this patient would have been saved under the present régime.

The Fredet-Rammstedt submucus pyloroplasty has been used in every case. It has been found entirely satisfactory and gives a permanent result, as shown by the follow-up. It may be done in about fifteen or twenty minutes, with no attempt made to hurry the operation. Ether by open cone was used in all but three cases, these three being done under novocaine block because of the presence of a respiratory infection. Local anæsthesia is un-

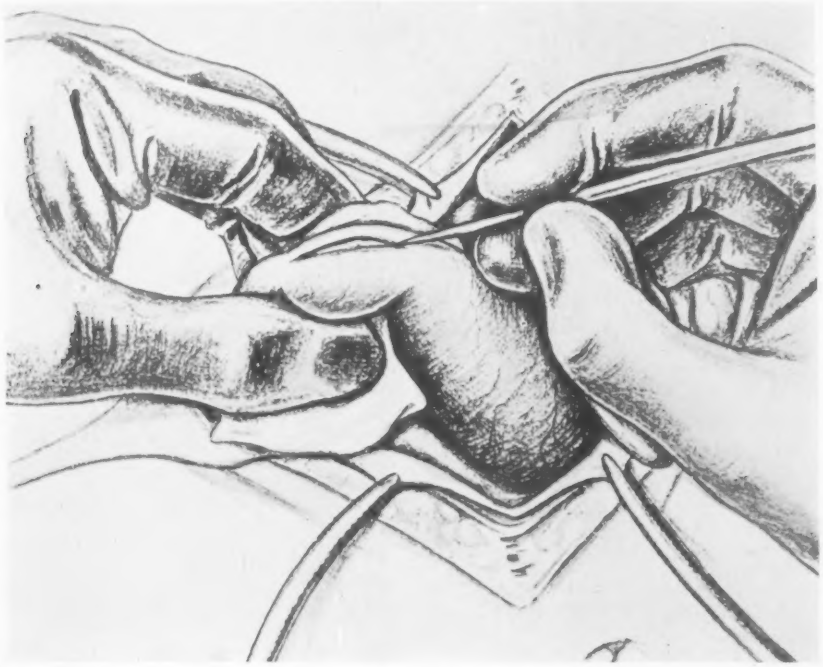

PLATE 2.—First step in Fredet-Rammstedt operation. Incision over the entire length of pyloric tumor through the peritoneum and superficial part of circular muscle only.

necessary in the majority of cases, prolongs the operating time and may interfere with wound healing. There has been no case of post-operative respiratory infection in this group. While the operation is mechanically simple there are a few details essential for its success. In order to maintain the body heat during operation, a hot-water bottle is placed under the child on the operating table. Just before the abdominal incision is made, the stomach is emptied by passing a soft rubber catheter, size 18F. The incision used is an upper right rectus about four centimetres long, one centimetre from the mid-line and high enough to completely overlie the right lobe of the liver. This not only makes closure of the abdomen easier but practically insures against post-operative wound rupture. When the abdomen is opened, the right lobe of the liver is retracted upward and the pylorus delivered into the

wound. The tumor is held between the thumb and index finger of the left hand. Beginning at the duodenal end, an incision is made over the entire extent of the tumor in its least vascular part and through the peritoneum and superficial part of the circular muscle only. The cut muscle edges are then separated with a small mosquito forceps until the mucous membrane completely fills the incision. Any bleeding encountered may usually be controlled by application of hot moist pads. If not, the vessel is underrun with fine black silk. In some of the older cases separation of the cut edges may be more difficult and more bleeding may be encountered. If it cannot be stopped by these means a small strip of muscle from the rectus may be

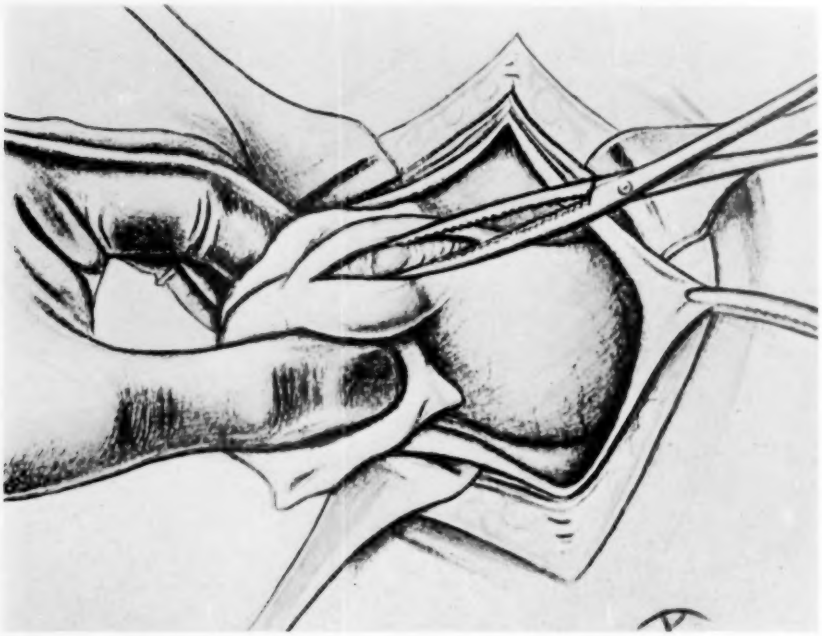

PLATE 3.—Second step in Fredet-Rammstedt operation. Beginning the separation of cut edges of pyloric tumor.

sutured in the pyloric incision. This procedure was necessary in only two cases. It is important to see that all bleeding is stopped before the abdomen is closed because some deaths have been reported from hæmorrhage from pyloric incisions.

After the bleeding is stopped, the pylorus is dropped back and the abdomen closed in layers, using continuous chromic for parietal peritoneum and anterior rectus sheath with Michel clips for the skin. A piece of gauze just large enough to cover the incision is strapped into place with adhesive in order that any bleeding from the incision may be quickly detected. From the operating room the child is taken to a constant-temperature room used exclusively for these cases. The head of the bed is lowered until he recovers from the anæsthetic to prevent aspiration of mucus. Two hours after operation, fifteen cubic centimetres of water are given by mouth, and four hours

after, the first feeding of four cubic centimetres of breast milk and four cubic centimetres of barley water is given. The breast milk and barley water are increased five to ten cubic centimetres with each three-hour feeding until the child is taken thirty cubic centimetres at the end of forty-eight hours. The breast milk is then increased five to ten cubic centimetres daily until the caloric requirements are met. One or two clyses of 3 per cent. glucose are given each day for the first three days. All feedings for the first five days are given with the medicine dropper, and breast-fed babies are allowed to nurse once on the fifth day, twice on the sixth day and so forth until they are completely breast-fed. If the baby is to be discharged on a formula,

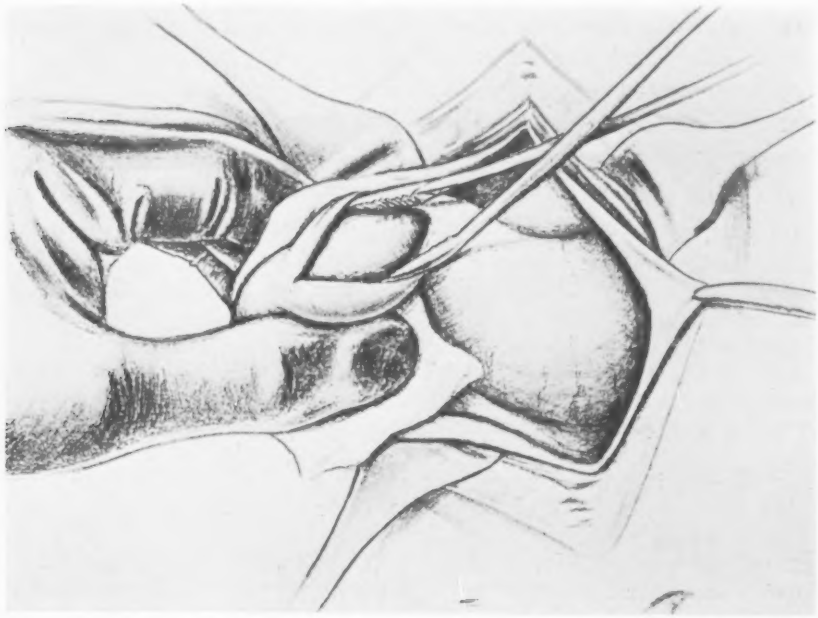

PLATE 4.—Third step in Fredet-Rammstedt operation. Completing the separation of cut muscle edges until the mucosa completely fills the incision.

evaporated milk seems to be well tolerated, and, beginning about the seventh day, one formula feeling is substituted for a breast-milk feeding until he is completely on the formula. These children have a low food tolerance because of their long period of starvation, and, therefore, post-operative feeding must be very carefully planned and an effort made to obtain breast milk for all patients for the first five days. With this routine, it is exceptional to have anything but a smooth convalescence, and 90 per cent. of these patients showed an appreciable gain in weight before being discharged from the hospital between the tenth and fourteenth days after operation.

The complication most to be dreaded in this operation is accidental opening of the duodenum. The change from thick pyloric tumor to thin duodenum is rather abrupt, and great care must be exercised in separating the cut muscle edges toward the duodenal end. This complication has not occurred

in this series. There has been no bleeding either from the pylorus or the abdominal incision. There have been three gross wound infections but none of them sufficient to materially interfere with convalescence. Wound edges have separated in three cases, and in each case an immediate resuture was done. There have been no post-operative ventral hernias to date.

All patients dying in the hospital have been reported as operative deaths. In this series of 119 cases, there were seven deaths, or a mortality of 5.9 per cent. Six of the seven deaths occurred in the first nineteen cases, one death in the last 100 cases. Two of the seven cases that died did well after operation for three and six days respectively, then became cyanotic and died very suddenly. No autopsies could be obtained. One patient died of shock ten hours after operation. One died of gastroenteritis one month after operation and another died of gastroenteritis fourteen days after operation. One child was reoperated upon through an error in judgment and died twenty-four hours after the second operation. The seventh patient died of inanition and marasmus five days after operation. A more detailed review of the hospital deaths is given below.

CASE I.—J. C., 25027, aged ten weeks. Admitted, September 19, 1924. Died, September 24, 1924. History of vomiting since birth. Transfused. Operation, typical Rammstedt. Large tumor. Died that night from weakness and shock. Autopsy showed no evidence of hæmorrhage.

CASE II.—R. M., 26680, boy, aged two months. Admitted, August 16, 1925. Operation, August 22, 1925. Died, August 28, 1925. Poorly developed, badly nourished, poor general condition. Large tumor. Typical Rammstedt. Baby did well after operation and died very suddenly on the sixth day. Became cyanotic and dyspnœic. No autopsy.

CASE III.—N. I., 27907, boy, aged ten weeks. Admitted, June 18, 1926. History of vomiting for two months. Poorly nourished. Transfused before operation. Operated upon four days after admission. Large tumor. Typical Rammstedt. Child continued to vomit and was not doing well. Explored and no evidence of trouble found. Child did not do well after second operation and died the next day. Autopsy showed nothing wrong with operation. Mistake to operate upon the child the second time.

CASE IV.—L. H., 28042, boy, aged thirty-nine days. Admitted, July 9, 1926. Died, August 2, 1926. History of normal labor. Birth weight, seven and one-eighth pounds. Began to vomit in second week. Transfused and operated upon as an emergency. Died about one month later, after typical gastroenteritis, having many loose stools daily. This child apparently had gastroenteritis at time of operation. At any rate, he had very bad stools immediately afterward, which persisted for three weeks until death. Bad judgment in operating at this time.

CASE V.—A. A., 28543, boy, aged three weeks. Admitted, October 16, 1926, and died, October 23, 1926. Poorly developed, premature, badly nourished, emaciated. Had thrush. Had not gained weight since birth, five and one-half pounds. Operation, typical Rammstedt. Child did very well for three days post-operatively, when he suddenly became cyanotic, dyspnœic, and died in two hours. Post-mortem abdominal examination showed no hæmorrhage and no infection.

CASE VI.—C. T., aged seven and one-half weeks. Admitted, October 20, 1926, and operated upon, October 22, 1926. Normal birth. Began to vomit at second week, continuing until he was vomiting everything. Typical picture of marasmus. Transfused on day of admission. Operated upon two days later. Typical operation. Very poor risk. Transfused after operation. Condition grew progressively worse, and he died five days

after operation from marasmus. Wound clean. Should have had his general condition improved more before operation.

CASE VII.—J. M., aged twenty-one days. Admitted, April 3, 1930. Admitted to medical ward four days before operation. Transfused before operation, when a large tumor was found. Typical Rammstedt. Wound broke open on the fifth day, requiring resuture. Died on the thirteenth day after operation from gastroenteritis, in spite of two transfusions. Only case that has died in the last 100 cases operated upon. No autopsy.

Ninety-five of the surviving 112 patients have been followed for periods of weeks to four years. Seventeen patients were lost to the follow-up. Three patients discharged in excellent condition died after leaving the hospital, one from erysipelas thirty days after leaving the hospital. His incision was clean, and he was entirely free from gastric symptoms. One died two weeks after being discharged from the hospital from sepsis as a result of a streptococcus sore throat. His wound was clean, and he was entirely free from gastric symptoms. One child died of sepsis ten days after leaving the hospital, the infection in this case being the result of furunculosis. His wound was clean and he was entirely free from gastric symptoms. The remaining ninety-two patients are alive and well.

In view of the fact that we have had but one death in the last 100 cases, I feel that it is safe to predict a mortality of 1 per cent. or less for the surgical treatment of this condition. If so, there is little to be said in favor of any other form of treatment for pyloric stenosis in infants since surgery can be regarded as safe and entirely satisfactory.

SUMMARY

(1) Analysis of 119 consecutive cases of hypertrophic stenosis operated upon by me at the Babies Hospital.

(2) Condition is more common in first children, and boys predominate 7 to 1.

(3) Vomiting is always the first symptom, and the average age of onset in this series was three weeks.

(4) A pyloric tumor is pathognomonic of the disease and can be felt in every case if a painstaking examination is made.

(5) Pre-operative preparation is the most important factor in lowering the mortality as the poorest risk can be converted into a case safe for operation in two or three days.

(6) Fredet-Rammstedt submucous pyloroplasty is the operation of choice and was done in all cases.

(7) Local anæsthesia is necessary only in the presence of pre-operative respiratory infection. It prolongs the operation and may interfere with wound healing.

(8) Accidental opening of the duodenum is complication most to be feared in this operation. It did not occur in this series.

(9) Seven deaths in 119 cases, mortality of 5.9 per cent. Six of these seven deaths occurred in first nineteen cases operated upon before the value

of pre-operative preparation was appreciated. There was only one death in the last 100 cases operated upon.

(10) Follow-up report on ninety-five of the 112 surviving cases: Three cases died after leaving the hospital from conditions independent of pyloric stenosis. All cases including these were entirely free from gastric symptoms.

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INFRA-PAPILLARY GASTRODUODENOSTOMY BY MOBILIZATION WITH RETROMESENTERIC DISPLACEMENT OF THE DUODENUM AND JEJUNUM

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Although the etiologic factors concerned in the causation of chronic peptic ulcer in man remain unknown and although the treatment, both medical and surgical, is still empirical, nevertheless there have been constant improvements in the rationale of the operative treatment of this condition, since 1881 when Nicoladoni[1] first devised gastroenterostomy. In the last fifty years many of the world's most renowned surgeons have concerned themselves with the development of various operations, the applicability of which depended primarily upon the anatomic variations of the patient and on the location of the pathologic lesion. These factors must undoubtedly be taken into consideration, but the physiologic effect of an operative procedure upon the stomach and intestine must also be thought of.

In the earlier years of the surgery of the stomach, the technical side of the operation was of major importance, while today one must consider as well the post-operative function of the stomach. As a result of post-operative examinations of patients as well as experimental animals, it has been found, in this clinic, that operations upon the stomach vary considerably in their physiologic effects, judged from the subjective sensations on the part of the patient and the analysis of the stomach contents after the injections of histamine. In brief, operations upon the stomach, in which an anastomosis with the small intestine is performed below or distal to the ampulla of Vater, result in a greater reduction of the acidity of the gastric juice, due to a reflux of duodenal contents, and a more rapid emptying time of the stomach than is the case in operations in which the anastomosis is made above the ampulla of Vater. In the latter type the analysis of the gastric contents reveals a persistent high free and combined acid with a delayed emptying time for the stomach. The object of any surgical procedure upon the stomach and duodenum for a chronic ulcerative lesion must be, first: to restore the disturbed function of the stomach as nearly as possible to normal, and second: to remove, if possible, the ulcer. It is with these two facts in mind that the operation to be described has been devised and employed.

Review of Literature.—Gastroduodenostomy was first suggested by Jaboulay[2] in 1892 and performed by him in 1894. This consisted of an anastomosis between the upper portion of the second or descending part of the duodenum with the anterior wall of the stomach. The duodenum was not mobilized, but the stomach drawn over and sutured to it. (Fig. 1.) Kümmell[3] in 1895 divided the duodenum, closing the proximal and implanting the distal end into the anterior wall of the stomach near the greater

curvature. (Fig. 2.) In 1898, Henle[4] reported "Ein Fall von Gastroduodenostomie," in which he had performed a simple subpyloric anastomosis between the anterior wall of the duodenum and the stomach. (Fig. 3.) Carl and Fantino[5] in the same year,

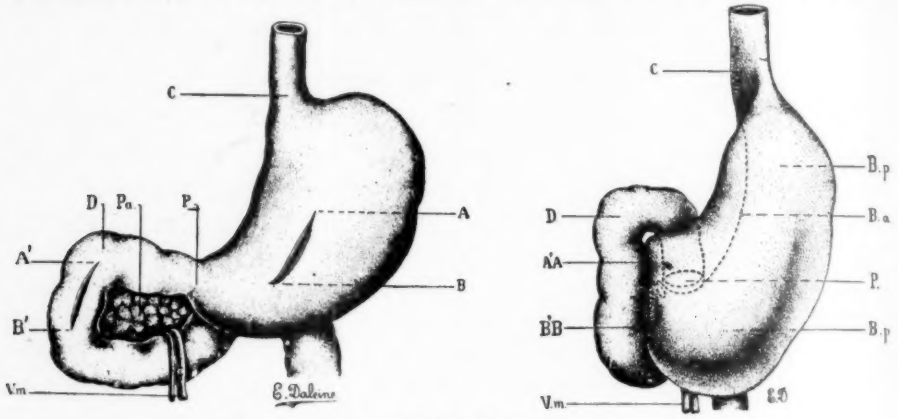

FIG. 1.—Method of Jaboulay.

1898, report one case of gastroduodenostomy which, like that of Henle,[4] was a simple subpyloric lateral anastomosis between the anterior wall of the stomach and the upper portion of the second or descending part of the duodenum. Villard[6] described practically the same operation previously reported by Henle,[4] as well as Carl and Fantino.[5]

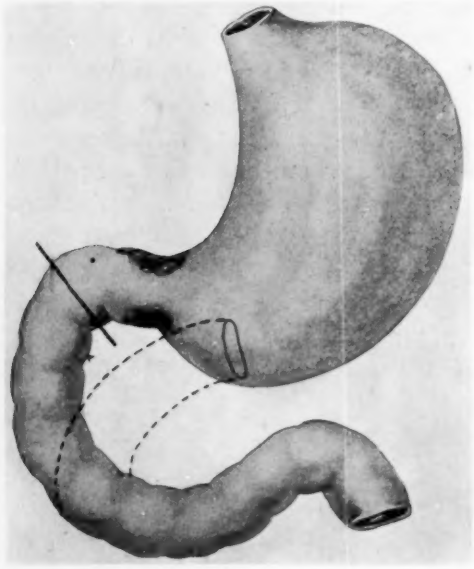

FIG. 2.—Gastroduodenostomy (Kümmell's method).

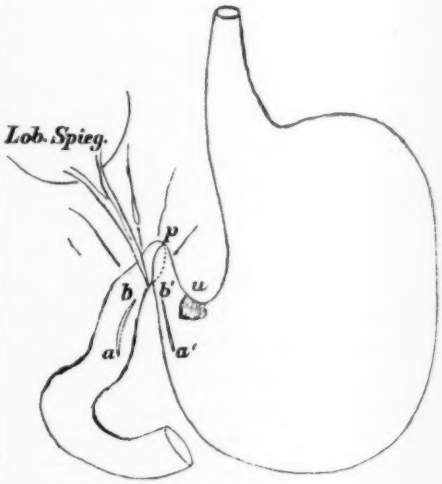

FIG. 3.—Method of Henle.

Villard's[6] "Gastro-Duodénostomie Sous-Pylorique" was published in 1900. No attempt to free the duodenum was made by either Henle,[4] Carl and Fantino,[5] or Villard.[6]

In 1901 Finney[7] performed for the first time the operation of pyloroplasty which now bears his name and was the first to methodically free the entire first, or superior portion, and the upper half of the descending portion of the duodenum. Five similar cases were reported by him in 1902. He did not use the word mobilize but advised to

"free as thoroughly as possible" the first twelve centimetres of the duodenum. In 1903 Kocher,[8] probably unaware of Finney's paper, as the latter was published in July 1902, whereas Kocher's appeared in January 1903, published his article on "Mobilisierung des Duodenum und Gastroduodenostomie" He mobilized the entire second or descending portion down to and including the inferior flexure of the duodenum. Kocher's mobilization of the duodenum was continued farther downward than that of Finney. A lateral anastomosis was then performed between the anterior wall of the stomach and the mobile second or descending portion of the duodenum.

In 1915 Moynihan[9] described a form of gastroduodenostomy which he later modified by shifting the incision in the stomach from a vertical one in the anterior wall of the pyloric antrum to one beginning at the pylorus and running parallel to the greater curvature of the stomach. (Figs. 4 and 5.) In 1917 Balfour[10] described a subpyloric anastomosis between the duodenum and stomach just below the pylorus with an inversion of the ulcer, if present on the anterior duodenal wall by two mattress sutures. (Fig. 6.) Balfour, although stating that he prefers gastrojejunostomy, in discussing the circumstances justifying a gastroduodenostomy makes this interesting statement under

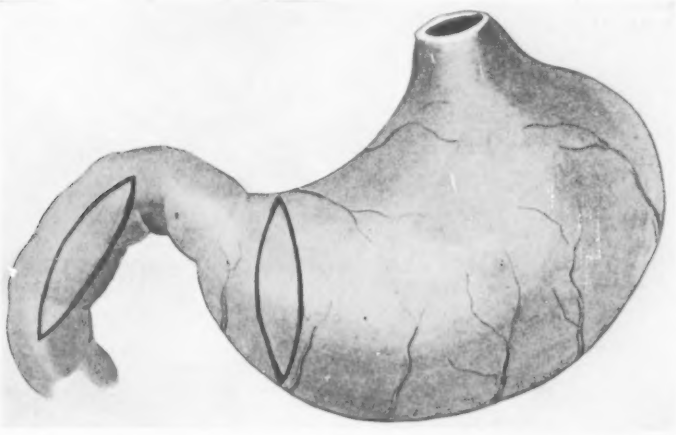

FIG. 4.—Gastroduodenostomy; showing the parts to be embraced by the clamp. First method of Moynihan. (Abdominal Operations, Moynihan, W. B. Saunders Co.)

his third indication for gastroduodenostomy: "In those instances in which patients have failed to obtain the expected relief from gastrojejunostomy because of secondary complications, such as gastrojejunal ulcer and mechanical difficulties; because the operation was ill advised or improperly done; or because of unknown reasons—in such cases gastroduodenostomy has been of signal value following the cutting off of gastrojejunostomy and the restoration of the walls of the stomach and jejunum." It would seem that if gastroduodenostomy were so efficacious a procedure secondarily, it might have been equally successful primarily.

In each of the above references, however, it is to be noted that the gastroduodenostomies were always performed between either the first or upper portion of the second part of the duodenum and the stomach. Also, it is evident that mobilization was performed only on the right side and was concerned with only the first and second portions of the duodenum.

In order to facilitate secondary operations upon the stomach following complications after gastrojejunostomy by increasing the length of the short afferent loop of jejunum, Schumacher[11] in 1910 and later Clairmont,[12] in

1918, mobilized the fourth or ascending portion of the duodenum from the root of the mesentery of the jejunum to Treitz' ligament, or the plica duodenalis mesocolica. They then performed a lateral anastomosis between the fourth or ascending portion of the duodenum and the efferent loop of jejunum. Freeing of the terminal portion of the duodenum was suggested by Schumacher and Clairmont only in case a secondary operation was necessary after a gastrojejunostomy following the development of an ulcus pepticus jejuni, extensive adhesions, and other post-operative sequelæ. No other references to the use of the fourth or ascending part of the duodenum could be found.

Operative Technic.—A right rectus incision is made about two centimetres to the right of the mid-line, extending from just below the right

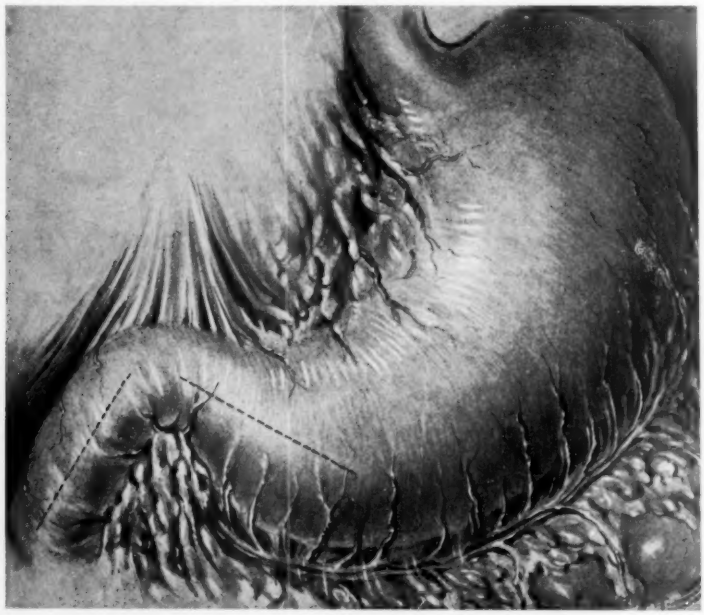

FIG. 5.—Second method of Moynihan. The lines of incision in the stomach and in the mobilized duodenum are shown. (Abdominal Operations, Moynihan, W. B. Saunders Co.)

costal margin to the level of the umbilicus. (Pl. I, Fig. 1.) This incision is curved slightly towards the mid-line in its upper portion, running parallel to the right costal margin for a distance of three centimetres. It is carried down through the skin and subcutaneous tissue through the anterior and posterior sheaths of the rectus muscle, splitting the rectus abdominis along the course of its fibres. The peritoneum is opened exposing the stomach and first or superior horizontal portion of the duodenum. A Mikulicz pad, moistened with warm salt solution is placed upon the transverse colon and omentum so that a gentle pulling inferiorly and downward may be made by an assistant. This places the posterior parietal peritoneum covering the anterior wall of the second or descending portion of the duodenum, on a stretch.

(It is to be recalled that the peritoneal covering of the anterior surface of the transverse mesocolon and the greater omentum fuse along the inferior border of the pyloric antrum, pylorus and inferior border of the first portion of the duodenum, continuing down over the anterior surface of the head of the pancreas and the anterior surface of the second or descending portion of the duodenum to become the peritoneal covering of the posterior and lateral wall of the abdomen.)

An incision is made through this reflexion of peritoneum just lateral to the right border of the inferior half of the second or descending portion of the duodenum. (Pl. I, Figs. 2 and 3.) It is then possible to obtain a plane of cleavage between the original posterior peritoneal lining of the abdominal

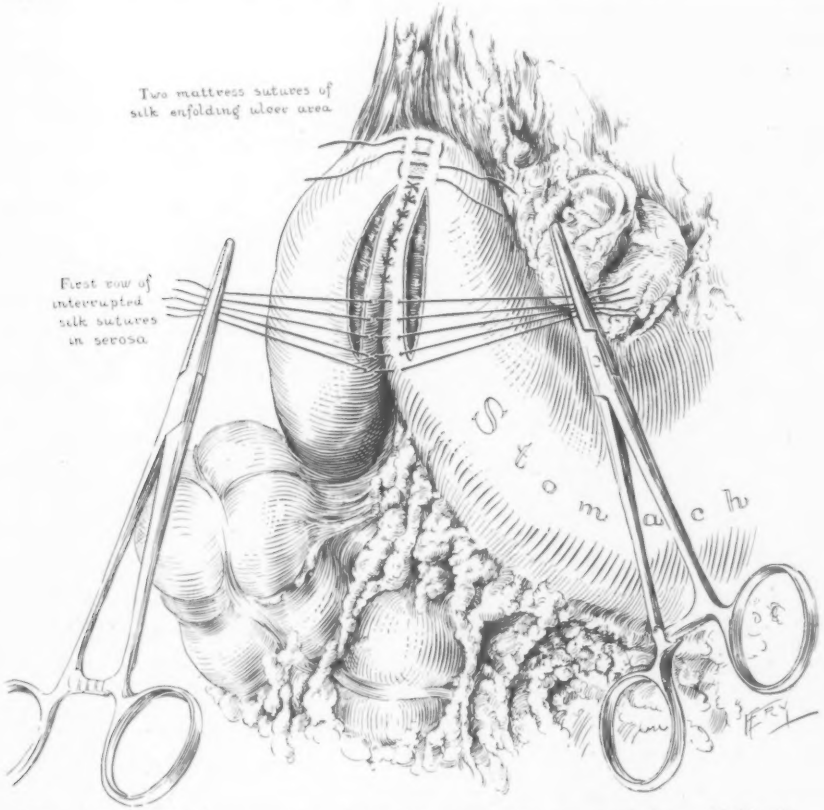

FIG. 6.—Gastroduodenostomy for obstructing ulcer with an angulation. (Balfour's Gastro-Duodenostomy.) (Mayo Clinic, W. B. Saunders Co.)

cavity and the peritoneum covering the posterior surface of the duodenum and pancreas.

By thus freeing the posterior surface of the pancreas and duodenum primarily, it is possible to lift the inferior angle together with the third or inferior horizontal portion of the duodenum, superiorly or upward and anteriorly or forward, thus putting on a stretch the loose areolar tissue which binds the posterior surface of the third portion of the duodenum to the posterior wall of the abdomen, and the inferior and anterior surface to the fused peritoneal coverings of the greater omentum and transverse mesocolon.

(It is to be noted that in the shifting of the stomach and large intestine in the embryo, the right side of the duodenum which is covered with peritoneum becomes the posterior aspect and fuses, excepting the first part, by loose areolar tissue to the peritoneum of the posterior abdominal wall. The peritoneal covering of the anterior surface then fuses in the same manner with the combined peritoneal coverings of the anterior leaf of the transverse mesocolon and the greater omentum.)

In this manner, by gentle blunt finger dissection the whole of the third or inferior horizontal portion of the duodenum, together with the entire head of the pancreas may be freed quickly and quite easily. No blood vessels of any consequence are encountered because the duodenum and pancreas receive their blood supply from the superior and inferior pancreatoduodenal arteries which run between the head of the pancreas and duodenum. (Fig. 7.) Thus the duodenum and pancreas are lifted free from the posterior abdominal wall revealing the right kidney, vena cava, vertebral column and aorta. Mobilization of the third portion of the duodenum is thus accomplished up to and beyond the point where the superior mesenteric vein and artery cross the anterior surface of this portion of the duodenum. (Fig. 8 and Pl. II, Fig. 1.) The peritoneal reflections of the mesentery of the jejunum have in the embryo fused with the peritoneum covering the anterior surface of the end of the third and the beginning of the fourth portion of the duodenum, so that the passage of the latter through the mesentery of the jejunum is readily mobilized. The superior mesenteric vein and artery course in the mesentery of the jejunum at a higher level about midway between the surface of the duodenum and the jejunum, and it is not necessary to expose them. The middle colic vein and artery are displaced slightly to the left and forward presenting no difficulty or hindrance whatsoever. The transverse colon and omentum are then lifted up so as to expose the posterior surface of the transverse mesocolon and the left surface of the mesentery of the jejunum. The fourth or ascending portion of the duodenum can be seen beneath the peritoneum covering the posterior abdominal wall. (Fig. 8.) The superior and inferior duodenal fossæ are at once seen (Fig. 8) with the reflection of peritoneum which above forms the superior duodenal reflection covering the areolar and muscle tissue running from the left crus of the diaphragm to the wall of the duodenum, and called Treitz' ligament. (Fig. 8.) This ligament or reflection is cut and an incision made in the peritoneum along the left margin of the ascending or fourth portion of the duodenum.

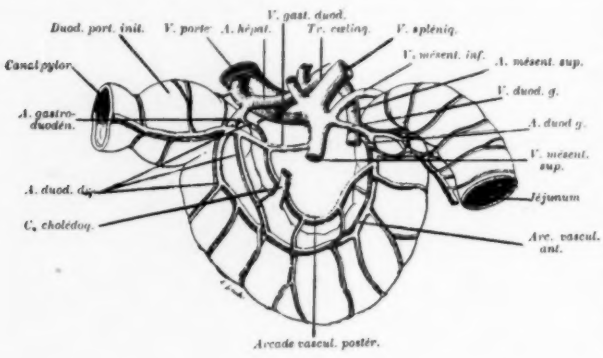

FIG. 7.

The inferior reflexion of peritoneum bounding the inferior duodenal fossa is also cut if present. The entire fourth or ascending portion of the duodenum is in this way mobilized and lifted free from its bed. Thus the lower half of the second or descending portion, the inferior angle together with the third or inferior horizontal portion, and the fourth or ascending part of the duodenum, is completely mobilized, lifted from its bed, and is freely movable in all planes right or left, superior or inferior, and anterior. As stated above, the freeing of the posterior surface of the pancreas is also accomplished up to the origin of the superior mesenteric artery from the anterior surface of

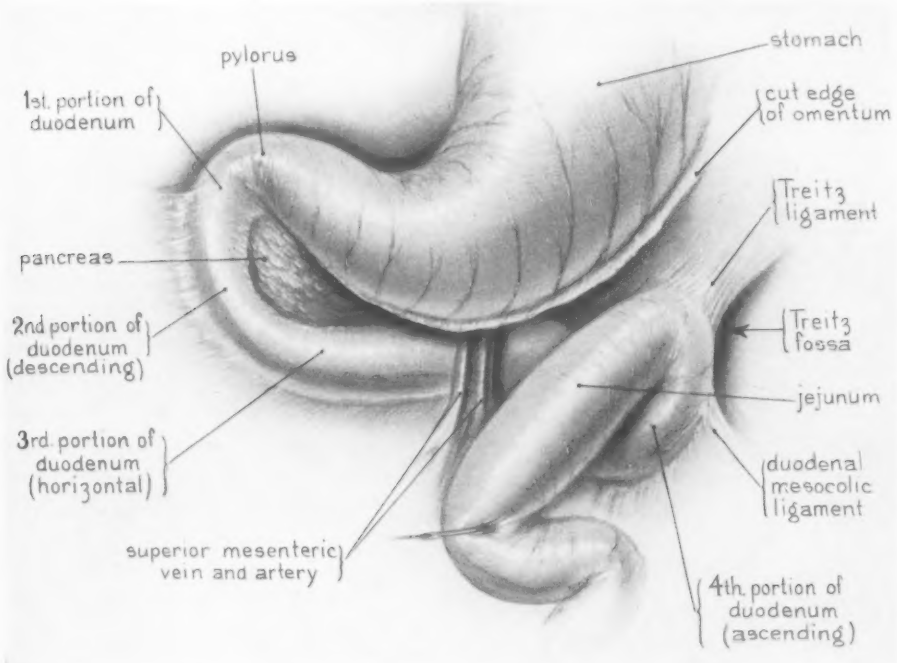

FIG. 8.—Drawing with colon removed from abdomen and greater omentum cut away from stomach to demonstrate the various portions of the duodenum. In this instance the jejunum passes from the left to the right side. In a large number of cases the jejunum runs down to the left instead of turning on itself to the right. This, however, does not interfere with the mobilization of the duodenum. The peritoneum overlying the third and fourth portions of the duodenum is incised at the inferior margin of the duodenum, and the duodenal mesocolic ligament together with Treitz' ligament are cut so as to free the duodenum and allow it to pass transversely to the right behind the mesenteric vessels. In some cases it would seem unnecessary to free the left or fourth portion of the duodenum in order to accomplish a gastroduodenostomy between the third portion and the stomach. However, in order to be certain of no kinking at the junction of the third and fourth portions of the duodenum behind the mesenteric vessels it is better to free the duodenum to the left of the mesenteric artery and vein.

the aorta. This latter procedure gives an extensive mobility to the third or horizontal portion of the duodenum. The transverse colon is then replaced into its normal position. The third or horizontal portion of the duodenum can now be brought up into the abdominal wound and anastomosed to the greater curvature of the stomach with great ease. (Pl. II, Fig. 1.) If desired, the anastomosis may be made higher up on the anterior surface of the stomach. It is surprising how mobile this third or horizontal portion of the duodenum can be made. Mobilization of the left portion of the duo-

denum or the ascending fourth part prevents any knuckling or kinking of the duodenum at the junction of the third inferior horizontal with the fourth ascending portion subsequent to the anastomosis. The location of the superior mesenteric vessels at a higher level in the mesentery leaves so much space between them and the bodies of the vertebræ that free passage of the duodenum is obtained beneath these vessels. Thus the free mobility of the third and fourth portion of the duodenum prevents kinking about these vessels because the lateral displacement of the fourth part of the duodenum to the right is only limited by the width of the mesentery of the jejunum, which is between 20-23 centimetres or eight to nine inches. The anastomosis between the stomach and duodenum is then performed five to fifteen centimetres below or distal to the ampulla of Vater, using the infra-papillary portion of the duodenum. The anastomosis may be accomplished in the following manner: applying the three-layer suture used by Dean Lewis with clamps or without the use of clamps, employing the Halsted presection mattress sutures. The former method is preferred because it is accomplished with less soiling and is more rapid. The anterior stomach (Pl. II, Fig. 1) wall in the most dependent portion of the pyloric antrum is grasped by two mucosa clips placed about seven to eight centimetres apart, just above the point of entrance and departure of the vessels of the greater curvature, and lifted up so that a rubber-shod clamp may be so placed that one blade, the inferior, rests almost directly on the greater curvature of the stomach. The rubber-shod clamp is gently compressed, only sufficiently to hold the stomach in place and prevent bleeding during the operative procedure. In a similar manner, the third or inferior horizontal portion of the duodenum is clamped in a rubber-shod clamp. The mucosa clips are removed and the anastomosis begun. A continuous suture of No. "C" carbolized waxed silk is introduced by means of a straight, round non-cutting needle. This enables one to accurately place the suture through the peritoneal and muscular coats, engaging a small but definite portion of the submucosa and remaining outside of the lumen of the viscus (Pl. II, Fig. 2). To accomplish this the needle must be a non-cutting one and should be introduced perpendicular to the surface of the viscus to be sewed. A silk suture improperly introduced into the lumen of the intestine will become infected and act as a drain along which infected material may escape, contaminating the entire suture line and causing the formation of adhesions or even suppuration. An incision is then made about one-half of one centimetre anterior to the first posterior suture line, through the peritoneum and muscular layers of the stomach and duodenum, for a distance of about six or seven centimetres, determining the length of the anastomosis to be made. This incision exposes the submucosa which herniates up as the lips of the incised peritoneal and muscular layers retract. A second posterior suture of chromic No. 1 catgut is then introduced (Pl. II, Fig. 2), which engages the submucosa as well as the peritoneal and muscular coats. This second posterior row serves not only to give a broad peritoneal approximation between it and the first posterior suture line, but also as a hæmostatic suture.

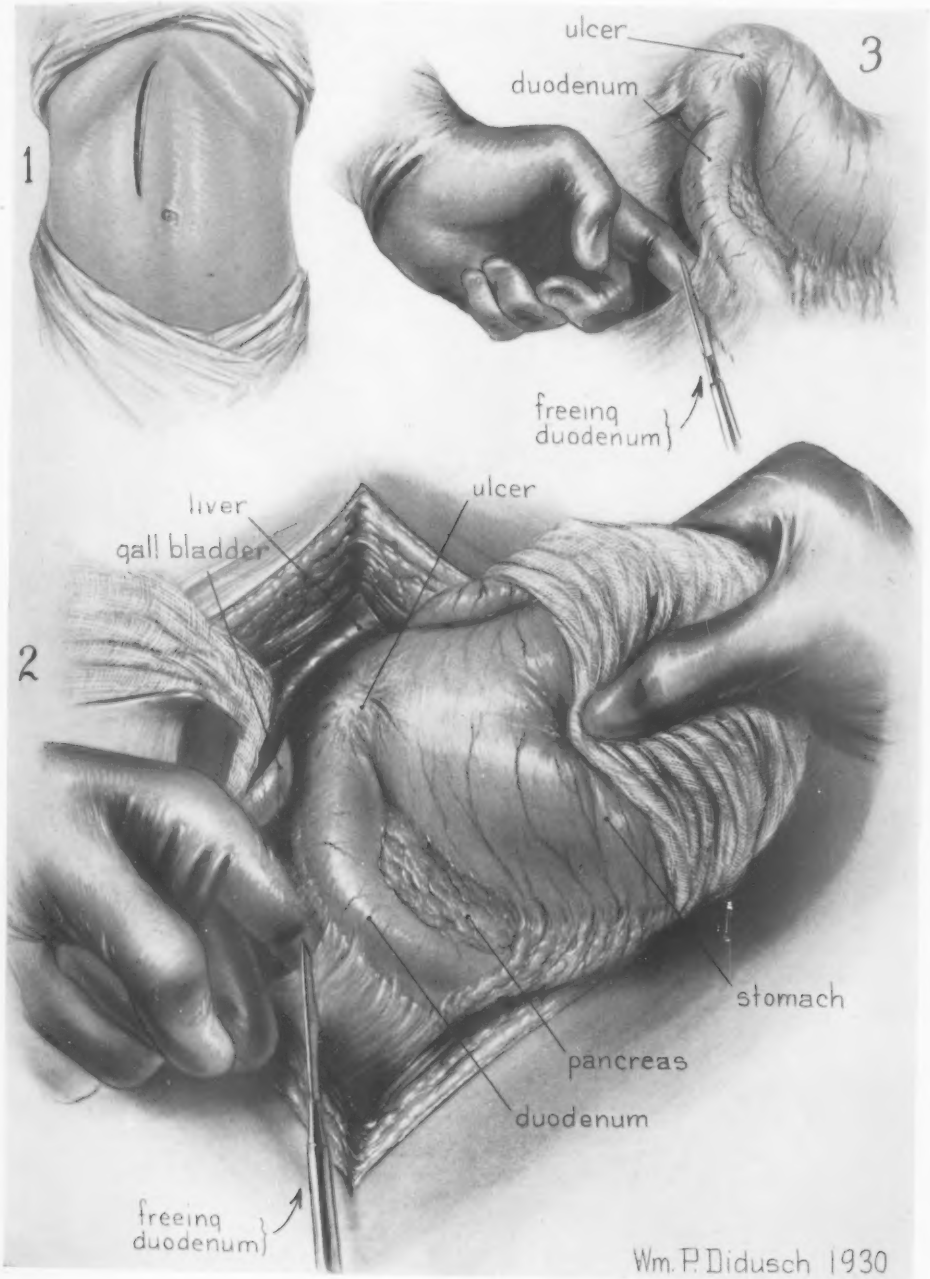
1
2
3
ulcer
duodenum
freeing duodenum
liver
gall bladder
ulcer
stomach
pancreas
duodenum
freeing duodenum
Wm. P. Didusch 1930

PLATE I.

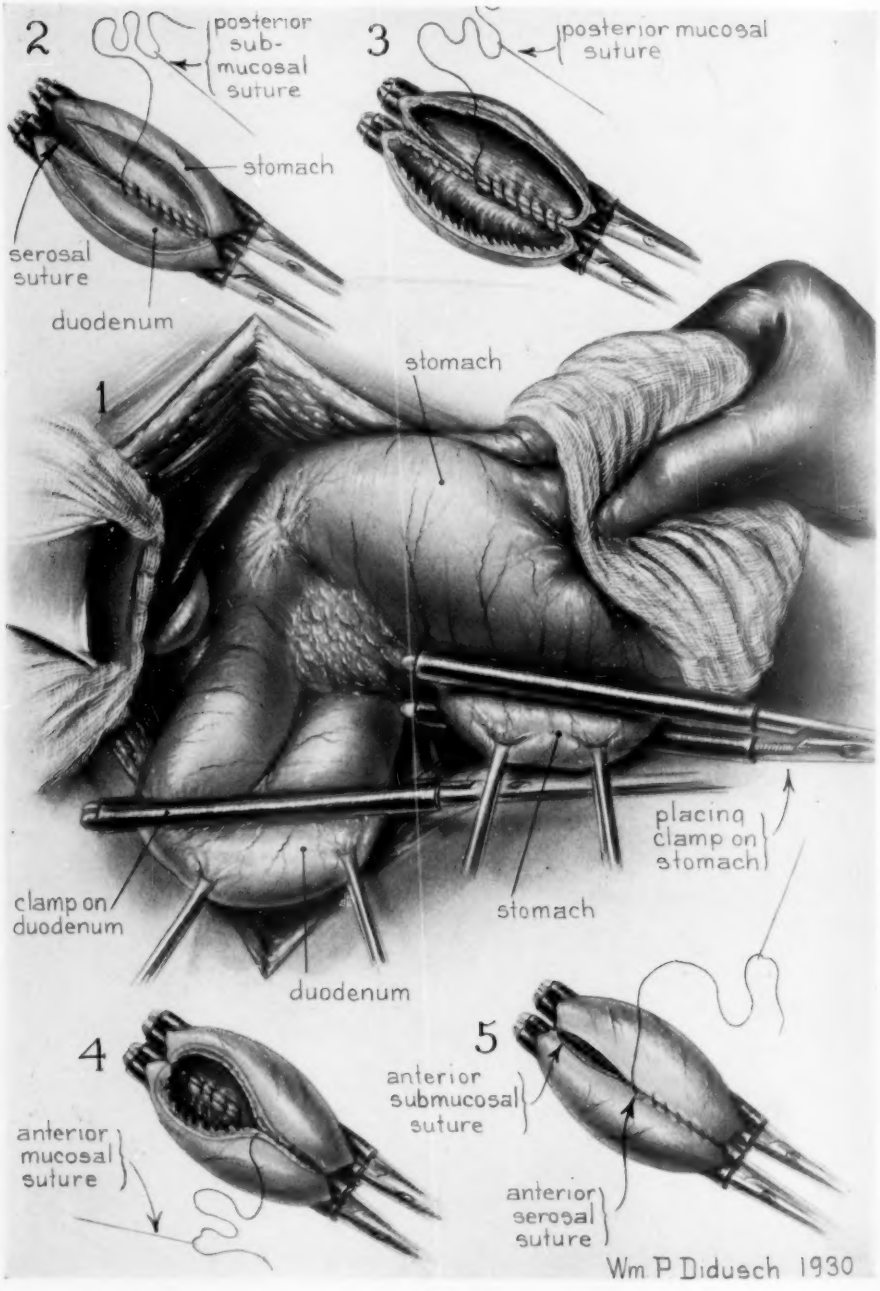
2
posterior sub-mucosal suture
stomach
serosal suture
duodenum
3
posterior mucosal suture
1
stomach
placing clamp on stomach
clamp on duodenum
stomach
duodenum
4
anterior mucosal suture
5
anterior submucosal suture
anterior serosal suture
Wm P Didusch 1930

PLATE II.

The lumina of the stomach and intestine are then opened and the mucosal layers both posterior and anterior are approximated by an over and over simple continuous suture of No. 2 plain catgut. (Pl. II, Figs. 3 and 4.) The second posterior row of No. 1 chromic catgut suture is continued, after locking this stitch at the angles, to become the second anterior row of suture. (Pl. II, Fig. 5.) The mucosa and cut edge of submucosa, muscularis and peritoneum are inverted by this line of suture. The rubber-shod clamps are removed and the first posterior row of No. "C" carbolized waxed silk is continued anteriorly, inverting again the first two anterior sutures. Care must be taken to invert as little of the stomach and intestine as possible so as not to cause too great an inturned flange. (This will become flattened out in the course of eight weeks, in the dog.) A Halsted mattress suture is usually placed just beyond each end of the anastomosis to relieve the suture line of any possible tension or traction. The remainder of the mobilized duodenum is allowed to fall back into its bed. A row of obliterating Halsted mattress and Lembert silk sutures are placed in the pylorus, causing a temporary stenosis. (Pl. III, Figs. 1, 2 and 3.) The entire first portion, together with the upper half of the second or descending portion of the duodemum, is avoided in this operation. The object being to have these portions of the duodenum fixed and anchored by their normal attachments to the extreme right. In this manner, the pulling over of the stomach and duodenum to the left is prevented. If all four parts of the duodenum are mobilized a kinking to the left may occur over the mesentery of the jejunum.* Besides, mobilization of the first and upper part will in no way affect the mobility of the third or horizontal portion of the duodenum.

Thirteen cases of chronic peptic ulcer have been successfully operated on by this method in the last two years. Two cases were operated on in 1925. The immediate, and so far, the ultimate results, in all, have been excellent. There has been no re-occurrence of their pre-operative distress, and so far they have been entirely free of all gastric symptoms. In all cases there has been a pronounced decrease in the free and total acidity of the gastric juice with bile always grossly visible in the stomach contents. The emptying time of the stomach has been about normal or slightly accelerated.

Discussion.—The advantages of this type of infrapapillary gastroduodenostomy are as follows:

(1) The anastomosis is formed between the stomach and the duodenum, which is physiologically better suited to receive the acid gastric juice than the jejunum.

(2) So far an instance of spontaneous ulceration of the third or inferior horizontal portion of the duodenum has not been reported so that the fascial cleavage about this portion of the duodenum is normal and not obliterated due to the scarring attendant on an ulcer or periduodenitis so commonly encoun-

* This occurred in one of the early cases operated upon in the Provident Hospital, causing a high obstruction.

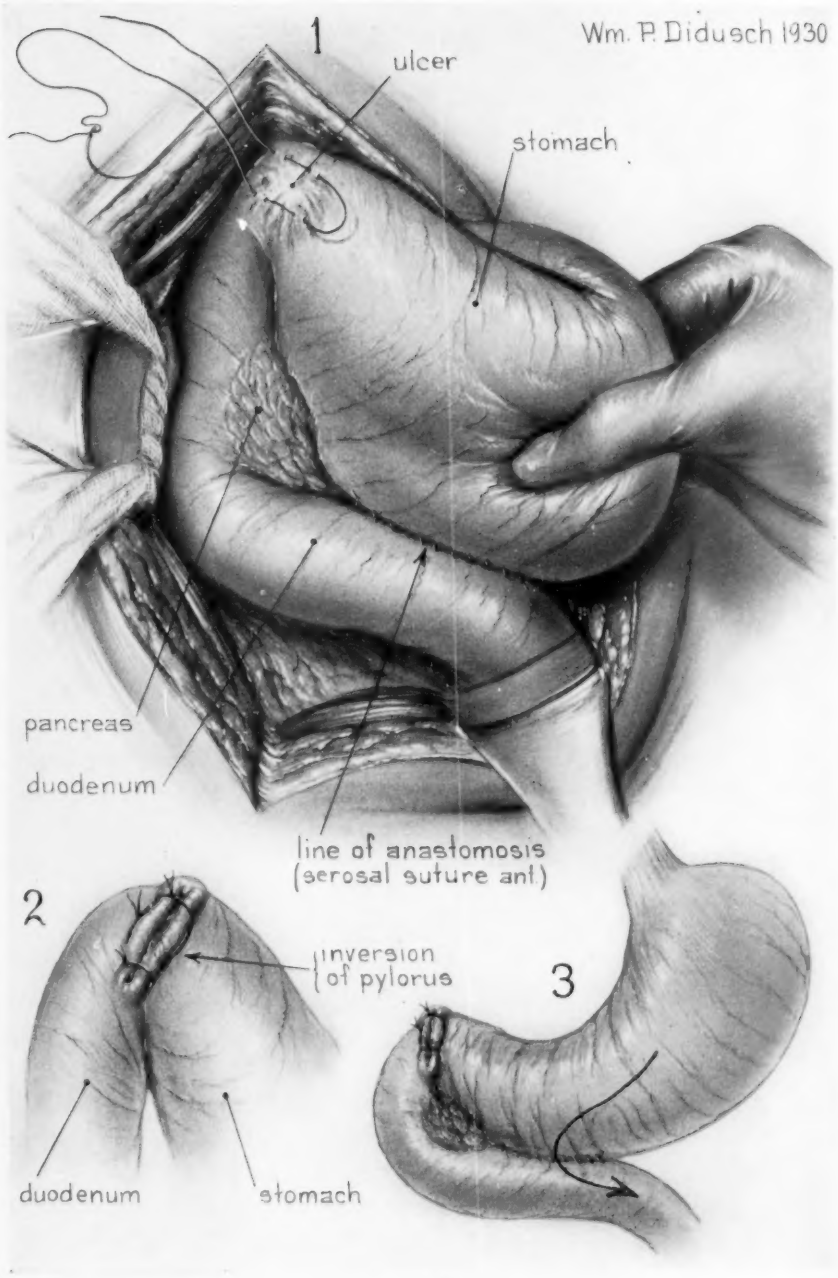
1
Wm. P. Didusch 1930
ulcer
stomach
pancreas
duodenum
line of anastomosis
(serosal suture ant.)
2
inversion
of pylorus
3
duodenum
stomach

PLATE III.

tered in the first and second portions. This fact insures relative ease in the mobilization of the duodenum and also provides a normal duodenal wall for use in suturing. Often in operating upon the first or superior portion, one is forced to suture indurated duodenal wall in the immediate vicinity of an ulcer.

(3) The third or inferior horizontal portion of the duodenum is more anteriorly situated and more accessible than the first and second parts.

(4) In the mobilization of the third portion there are no structures such as the ductus choledochus and pancreatic ducts in the vicinity which might be injured during mobilization.

(5) Marginal ulcer which according to different observers is reported as occurring in from 3 per cent. to 25 per cent. of cases of gastrojejunostomy does not occur in the duodenum following gastroduodenostomy.

(6) The transverse mesocolon does not have to be transversed as in gastrojejunostomy. A large per cent. of the post-operative complications of gastrojejunostomy has been due to obstruction at the site of the anastomosis because of the contraction of the mesocolon on the jejunum.

(7) The most dependent portion of the stomach is the greater curvature of the pyloric antrum where the anastomosis in this operation is made. Thus from a mechanical standpoint the maximum drainage is afforded. The stomach contents are always pushed towards the pylorus so that an opening in the antrum affords more prompt and efficacious drainage than one further back towards the fundus of the stomach.

(8) The continuous and abundant reflux of bile, pancreatic and duodenal secretion into the stomach causing a neutralization of the free and combined acid, is probably the most important factor in the operative or surgical treatment to bring about healing of a peptic ulcer. Following pyloroplasty or suprapapillary gastroduodenostomy, the hyperchlorhydria persists after operation and, according to the general opinion which has been held in the past, the great desideratum, was to establish an opening between the stomach and intestine which would remain patulous and through which at the same time the bile and stomach contents would not tend to regurgitate. In all operations in which the anastomosis is performed above the ampulla of Vater, undoubtedly the minimum amount of duodenal contents will find its way into the stomach. However, our opinion of the most desirable effect following such operations has changed, so that now the maximum reflux of bile and duodenal contents into the stomach is to be preferred.

(9) Excision of an ulcer or a large portion of the stomach may be performed simultaneously with this form of infrapapillary gastroduodenostomy.

Undoubtedly, the major therapeutic effects of an operation upon the stomach for the surgical treatment of chronic peptic ulcer are the establishment of prompt and efficacious drainage of the stomach together with alkalinization of its secretions by the reflux of the duodenal contents. In an as yet unpublished experimental study on dogs and clinical observations on patients in the Johns Hopkins Hospital[13] together with the recent study of Gaither[14]

the observation has been made that in order to produce a maximum reflux of duodenal contents into the stomach the opening into the intestine must be below the ampulla of Vater. The different types of pyloroplasty and supra-papillary gastroduodenostomy between the stomach and the first or upper part of the second portion of the duodenum, all have a persistent post-operative high acid content in the stomach and delayed emptying time. In contrast to these findings, following the infrapapillary gastroduodenostomy the reflux of bile is abundant in the gastric contents with a resultant low post-operative acidity, and the emptying time of the stomach is somewhat accelerated above normal.

The advantages of this procedure in respect to gastroenterostomy using the jejunum are, first: the duodenum is undoubtedly better suited for the reception of the acid gastric contents. Second, spontaneous ulcer has not been observed in this third or inferior horizontal portion of the duodenum, and no instances of marginal ulcer occurring in the duodenum have occurred in this clinic following any type of operation between the stomach and duodenum. Third, the necessity of going through the mesocolon is avoided. Fourth, unquestionably the closure of the pylorus is an advantage and therefore it is mechanically better to place the junction of the stomach and intestine as near the pyloric end as possible. In this operation the stoma between the stomach and intestine is much further to the right than in gastrojejunostomy. Thus if the pylorus is closed, the large blind pouch of stomach remaining after gastrojejunostomy is avoided.

Regardless of the fact that the great portion of the duodenum has lain in a retroperitoneal position and the free mesothelial surface of its original peritoneal covering has become somewhat covered with a very loose areolar tissue, nevertheless, the peritoneal layer remains distinct, and possesses the power of agglutination originally ascribed to it in 1824 by Jobert.[15] No difficulty has been encountered in the healing of this surface of the duodenum.

Although the mobilization of all but the superior portion of the second part of the duodenum has been performed in this operation for the treatment of benign ulcerations of the stomach and duodenum, the surgical importance of this procedure is more far-reaching. When the third or inferior horizontal portion and the fourth or ascending portion of the duodenum is completely free, not only the entire duodenum but also a considerable length of the jejunum may be drawn posterior to the superior mesenteric vessels with great ease and without the slightest kinking of the bowel or disturbance of the circulation in the mesentery.

When the jejunum is drawn underneath the superior mesenteric vessels to the right side, the latter are rotated slightly less than 90° in their long axis which does not interfere with the blood flow through them. This rotation of the mesentery of the jejunum, resulting from a complete freeing of the duodenum, makes available for use on the right side of the mesentery and above the mesocolon, a sufficient length of jejunum to perform an anastomosis with the duodenum just below the ampulla of Vater, or with the stomach high up on the fundus. The importance of this procedure is

at once evident in all cases in which it is desirable to resect the duodenum for traumatic or pathologic changes and further to facilitate the technical difficulties encountered in secondary operations for marginal ulcer or obstructions following gastrojejunostomy.

Conclusions.—For the reasons given above it is felt that the infrapapillary gastroduodenostomy is to be preferred to other types of gastroenterostomy. It is to be recognized that there is a small but definite percentage of cases in which this operation is not applicable.

Mobilization of third (horizontal) and fourth (ascending) portions of the duodenum and the first portion of the jejunum with their retromesenteric displacement from the left to the right side is of value as well in surgical procedures for conditions other than chronic peptic ulcer.

Every case of chronic ulceration of the stomach and duodenum should be considered individually from the surgical standpoint and it is only by the application of various operative procedures dependent upon the anatomic and pathologic conditions which supervene and with regard for the physiologic effect of such various operative procedures upon the stomach that the best results will be obtained. It is in the hope that this operative procedure may prove helpful that it is called to the attention of those interested in the surgical treatment of ulcerative lesions of the stomach and duodenum.

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HEMOPHILIC ARTHRITIS

(BLEEDER'S JOINTS)

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In spite of the fact that the majority of hemophilics who reach the age of puberty are subject to joint disturbances, hemophilic arthritis is a rather rare condition and most of the affected individuals know that they are bleeders and promptly inform the surgeon of this fact when any operative procedure is considered. Consequently, it does not occur to the average surgeon that he may some day open a hemophilic joint under an erroneous diagnosis. This, in spite of the facts that a hemophilic arthritis may closely resemble conditions for which operative intervention is indicated and that the literature contains several reports of surgical tragedies which resulted from operations upon hemophilic joints under an erroneous diagnosis. Consequently, it is important that surgeons who operate upon joints should know thoroughly the clinical picture of hemophilic arthritis.

In this paper I wish to report an unhappy experience of my own in which a fatality was narrowly averted, and also wish to describe for the first time in English the clinical picture and pathology of hemophilic arthritis as well as to make certain additions to our knowledge of the subject which have resulted from the study of my operated case.

N. McG., aged thirteen, was referred to the St. Louis Children's Hospital from the dispensary for the removal of a painful tumor over the mesial condyle of the right femur. The dispensary diagnosis was old calcified hematoma. He was admitted to the hospital September 5, 1929.

His father was believed to be living and well, but had not been heard from for several years. His mother died following childbirth, but not from hæmorrhage. One sister was living and well at the age of twenty-six. Five sisters and brothers had died in infancy from pneumonia or diphtheria. No history of bleeders in the family.

The boy had had measles and pertussis in infancy. He has always bruised easily and large, hard, blue-black swellings followed the bruises and lasted several days. At the age of three he bled several days from a small cut in the tongue. He always had to bandage small cuts very tightly in order to stop the bleeding. He has had occasional nose bleeds, but they never lasted over thirty minutes. There was no especial bleeding following the removal of the deciduous teeth. From time to time he has been troubled with painful swellings of one or more joints. The swellings usually occurred spontaneously as he was not able to recall any injury. The involved joint became enlarged, tense, and painful. This condition persisted for from a few days to a week and then gradually subsided and the joint returned to normal. An exception to the above was the right knee, as will be mentioned below. The joints involved were the right knee, both ankles, both elbows, and various joints of both hands and fingers.

He is quite positive that the subcutaneous hematomata and joint swellings have been much less frequent during the past two years.

At the age of five years he fell and struck the right knee on the pavement. The knee became markedly swollen and painful and the patient remained in bed about a month. The pain gradually disappeared and the swelling decreased, but some swelling persisted over the internal condyle of the femur and the knee remained flexed. This swelling and flexion deformity have persisted until the present time and the swelling has always been quite tender. From time to time the knee has been markedly swollen and painful. These attacks have usually followed a slight injury and have caused him to remain in bed for from four to fourteen days. He does not know how many times the knee has been swollen, but states that the number is large. The last time was about six months ago.

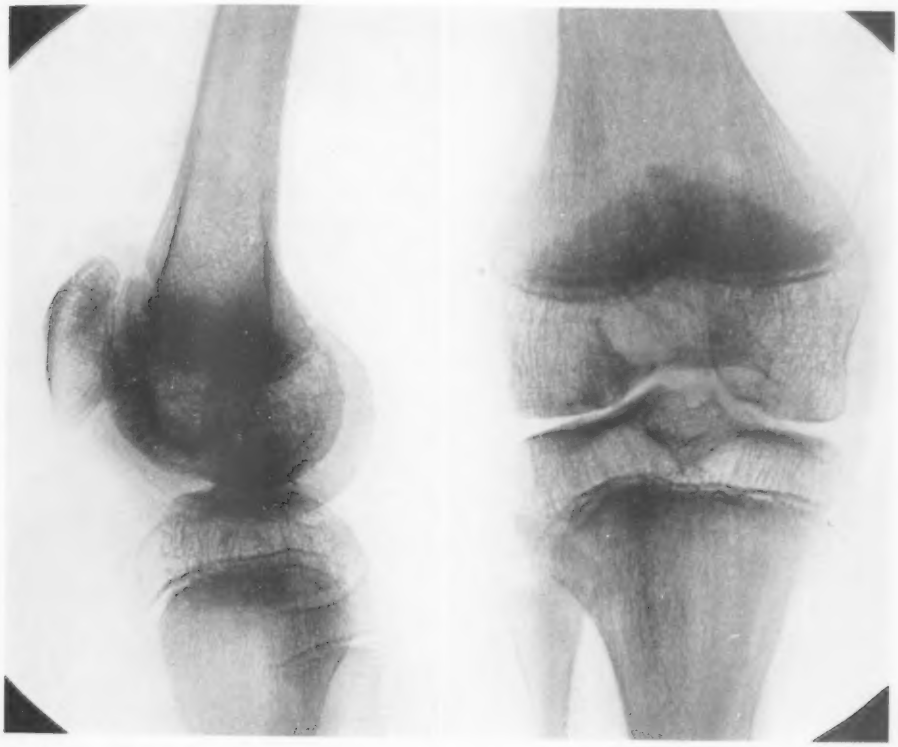

FIG. 1.—X-rays of knee of hemophilic arthritis before the operation. The characteristic dark shadows in the periarticular tissues do not show in the prints, but the larger rarefied areas may be seen in the femur and tibia.

He was a pale, slender boy, height sixty inches, weight seventy-nine pounds. General physical examination was negative excepting a soft blowing systolic murmur at the heart apex. All joints were normal except the right knee. There were 30 degrees of permanent flexion of the right knee and a valgus deformity of ten degrees. Flexion was limited to 90 degrees by pain and motion was accompanied by soft crepitus. There was no actual shortening of the extremity or atrophy of the calf, but there was 1.5 centimetres atrophy of the thigh. The right knee was slightly larger than the left and the internal condyle of the femur was unusually prominent. On palpation no excess fluid was demonstrable in the joint, but the joint capsule was felt to be thickened and constricted. Its margins had a rubber-like consistency and could be rolled beneath the fingers. The thickening was especially marked over the internal condyle of the femur and here a hard cartilage-like mass was palpable. There were no redness or

local heat, but this mass was quite tender and was continuous with the thickened capsule and could be moved slightly upon the underlying bone.

The above history was obtained after the operation. The case came under my care when I was asked to look after the orthopœdic service for a few days while the surgeon in charge was out of the city.

Laboratory findings.—Urine, normal. Wassermann, negative. Red blood-cells, 4,590,000. White blood-cells, 9400. Hb., 70 per cent., Blood clotting time, seven minutes (done in the dispensary).

X-Ray findings.—(Fig. 1.) Antero-posterior view, right knee: The X-ray shows moderate enlargement of the bones of the right leg, the lower end of the femur being nine centimetres broad on the right and eight centimetres on the left. The bones are quite atrophic. The epiphyseal line is not markedly irregular, but is doubly contoured, especially over the external condyle, and is broadened. In addition to the atrophy there is a rather large circular area of rarefaction in the mesial portion of the external condyle of the femur, which is surrounded by a narrow zone of dense bone. This area is one and one-half centimetres in diameter. There is a smaller ovoid area of rarefaction in the internal condyle near the joint surface and a similar small area near the border of the external condyle.

The condyles of the tibia are enlarged in about the same proportion as are those of the femur, and the bone is rarefied, and shows a circumscribed area of rarefaction similar to those in the femur and located just below the spines of the tibia. The joint space is narrowed, the articular surfaces are roughened and the small areas of rarefaction in the inner condyle of the femur are unusually prominent while the lateral borders of the condyles are serrated. The intercondylar notch in the femur is moderately broadened and deepened. The spines of the tibia are slightly more prominent than are those on the other side.

In the periarticular tissues, especially over the mesial portion of the joint, are rather dense shadows which are in places circumscribed and quite sharply defined. These do not appear to be attached to the bone, but merge into the mass of the surrounding capsule, which is more opaque than usual.

Lateral view, right knee: The bones are atrophic and the joint space is narrowed. There is a large area of rarefaction one and one-half centimetres by two centimetres in the epiphysis of the femur which begins at the epiphyseal line and extends downward almost to the end of the condyle. This is surrounded by a thin zone of dense bone. There is a similar smaller defect in the anterior portion of the epiphysis of the tibia. The joint capsule appears to be unusually dense and casts a definite shadow, which is especially marked in the region of the posterior capsule. The patellar tendon bulges forward as though the fat pad were enlarged and the fat pad casts a shadow which is more dense than is that on the other side. The articular surfaces of all the bones are very thin and slightly roughened.

As I had obtained only a history of an injury with resultant deformity and disability, it was my impression that this was a traumatic arthritis and that the tumor was a mass of fibrous tissue or cartilage which should be removed. This impression seemed to be confirmed by a casual glance at the X-ray which I first saw just before I made the incision.

Operation.—September 9, 1929. Under a tourniquet, a longitudinal incision about five inches long on the mesial side of the patella was carried down through the capsule of the joint. The skin and subcutaneous tissue and joint capsule were apparently normal. Beneath the fibrous capsule and separated from it by a small amount of areolar tissue a layer of dense fibrous tissue was encountered. This was incised in the line of the incision down to the synovial membrane without opening the synovial cavity. The synovial membrane was unusually dark in color. A small opening was made in it and about twenty cubic centimetres of blood flowed from the joint cavity. This blood was dark in color, though not the purplish color of venous blood, and it

contained no clots. At this point in the operation the diagnosis of hemophilic arthritis was made, but since the damage was done there seemed to be no reason why an attempt should not be made to relieve the patient of the tender swelling over the internal condyle provided he survived the effects of the operation. Consequently, the operation was continued.

The incision in the synovial membrane was enlarged and the joint was inspected. The synovial membrane was dark chocolate in color and the joint cavity was filled with hypertrophied synovial folds and villi. The articular cavity was smaller than normal and this was particularly true of the quadriceps bursa, which extended only about half an inch above the patella and was crossed by several bands of synovial tissue.

The fat pad was unusually dense and fibrous in character and a thick fold of dense synovial tissue extended along the mesial border of the patella and tended to overhang the articular margin of that bone. The articular cartilage on the femur, tibia, and patella was yellowish-brown in color and contained many areas in which the cartilage was either thinned or had entirely disappeared and in the eroded areas the underlying bone was covered by a delicate chocolate-colored connective tissue.

These areas of thinning and erosion in the articular cartilage were irregular in size and contour and suggested the sharply demarcated maplike appearance as described by König.[1] There was also some marginal erosion of the articular cartilage and a very thin narrow marginal zone where the cartilage appeared to be invaded by the hyperplastic synovial tissue, but no definite pannus was present and there was no tendency to the formation of marginal osteophytes or ecchondroses. The erosion and thinning of the cartilage seemed to be from the underlying bone as the eroded areas did not correspond to the areas of greatest pressure in the joint and in the thinned areas the surface of the cartilage was smooth. The semilunar cartilages were pale, reddish-brown in color, but were normal in other respects.

The patella was not displaced outward as it was not deemed advisable to enlarge the incision sufficiently to permit this. The thickened mass of synovial tissue and dense fibrous subsynovial tissue which covered the anteromesial aspect of the mesial condyle of the femur was excised *en bloc*, as was the thick band which extended along the mesial border of the patella. Then with a knife a small bit of the margin of the articular cartilage of the femur approximately one-half by one centimetre was excised. It was found that the underlying bone was very atrophic and could be cut easily with a knife.

All visible vessels were then ligated and the wound was carefully closed in layers and a pressure dressing applied before the tourniquet was removed.

The patient was returned to the ward in good condition and orders were left that he be kept quiet with morphine, the limb elevated and that he be matched for transfusion and transfused immediately if any unusual amount of bleeding occurred.

During the afternoon the leg became cyanotic and covered with small purpuric spots (subcutaneous hæmorrhages). Consequently, the dressing was loosened.

September 10.—The day after the operation, fresh blood appeared on the dressing at 11:00 A.M. The dressing was tightened and the bleeding stopped, but reappeared in about an hour and continued until four o'clock in the afternoon, when it seemed to cease spontaneously. He was transfused at 5:00 P.M., receiving 300 cubic centimetres of whole blood. After the transfusion the bleeding began again and I saw him for the first time since the early morning, at which time his condition had been good. I removed the large blood-soaked pressure dressing and found that there was no general ooze but that a small artery was loose near the upper end of the wound. The bleeding could be stopped at will by compressing this against the femur. This was ligated by passing a curved needle into the incision and under the artery and out through the skin. It was not necessary to open the wound. Bleeding stopped.

September 11.—Second transfusion, 500 cubic centimetres whole blood.

September 16.—The knee began to swell and was quite painful.

September 19.—Temperature was 39.8° by mouth. The knee was very tense and painful and a small amount of blood was oozing from the wound. The skin edges were necrotic in places from the tension. Knee aspirated and 120 cubic centimetres of old blood were removed. Smears and cultures of this were negative for bacteria.

September 20.—Knee again very tense and skin edges beginning to separate. Eighty cubic centimetres of old blood were removed by aspiration. A good deal of blood remained in the knee, but this was apparently clotted. Smears and culture of the aspirated blood were negative for bacteria.

September 22.—The wound continued to look bad and a plaster bandage was applied and the extremity elevated.

September 23.—A window was cut in the dressing and all sutures were removed. As the sutures were removed the edges of the wound separated, revealing a large blood clot (about eight by five centimetres) which completely filled the anterior portion of the joint. This was firmly adherent to the front and inner side of the femur.

September 25.—Third transfusion, 500 cubic centimetres whole blood.

October 1.—The clot was lifted out, leaving a necrotic base.

October 14.—Plaster bandage removed and Thomas splint and adhesive traction applied to correct the flexion deformity, which was now about 60 degrees. The

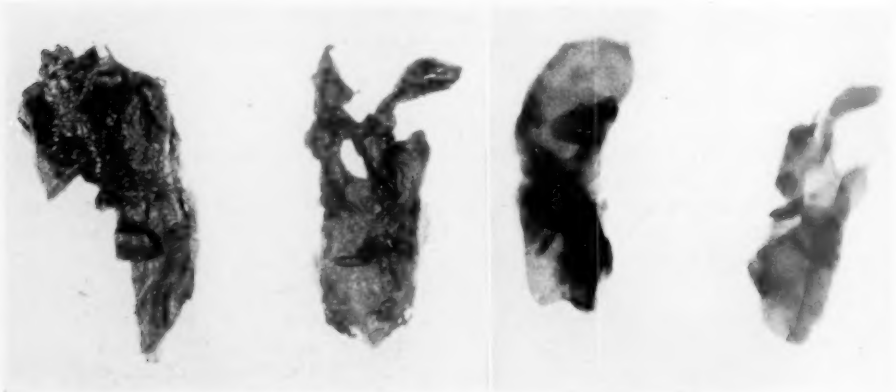

FIG. 2.—Photograph on the left and X-ray on right of part of synovial membrane removed at operation. The dense shadow cast by this tissue in the X-ray is due to the large amount of iron in it.

necrotic tissue had by this time separated and the wound was comparatively clean and its edges were being pulled together by adhesive strips. From this time on the convalescence was uneventful and the patient left the hospital on crutches.

The blood-platelet count was first done September 11, after the first transfusion, and daily thereafter until September 26. On the eleventh the platelet count was 284,000 and it rose slowly to 386,000 on the eighteenth. At this time the patient was started on twenty minims of irradiated ergosterol (acterol) daily and the platelet count rose rapidly to 745,000 on the twenty-second and remained at about this level during the period of observation.

The red blood-cells numbered 4,100,000 on admission and 3,810,000 after the second transfusion. Although there was no further bleeding the red blood-cells gradually dropped to 2,380,000 on September 25. This occurred while the platelet count was steadily rising to 745,000, under the influence of acterol. After the third transfusion the patient was put on a liver diet and on October 18 the red blood-cells were 4,100,000, hæmoglobin 70 per cent., white blood-cells 11,400, and clotting time eight and one-half minutes (one-half minute longer than it was before the operation).

The temperature rose after the operation and reached 37.6° on the fourth day. On the eleventh day the temperature reached 39.8°. At this time the knee was dis-

tended with blood and infection was suspected, but no growth was obtained from the aspirated material.

Pathological Examination of Material Removed.—Gross Description.—(Fig. 2.) The specimen consists of a mass of synovial membrane five by four centimetres in diameter and two smaller pieces. The synovial membrane is dark cholocate color. Much of the surface is covered by numerous large and small rounded villi, folds and synovial bands. Some of the villi are pedunculated and are attached to the surface by long slender pedicles while others are sessile in character. Many of the folds and villi branch extensively and in some areas they form an intricate moss-like structure. On section these large villi are quite friable, contain no visible fibrous tissue, have the appearance of raw calves' liver and some of them contain deep clefts or cavities which are filled with unclotted blood. The subsynovial tissue contains a layer of dense white fibrous tissue which in some places is four millimetres in thickness. The delicate synovial membrane can be stripped from this with comparative ease.

In addition to the above, there is a small fold of dense fibrous tissue about one

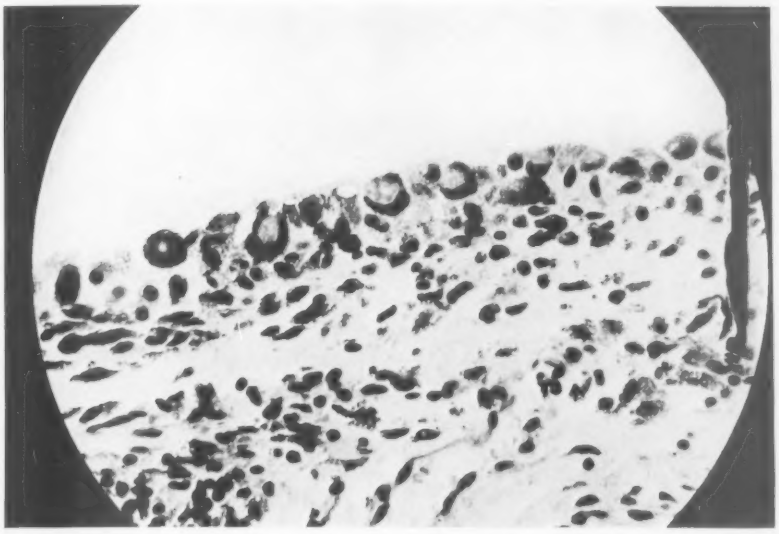

FIG. 3.—Synovial surface. The large cells along the surface are monocytes and the large granules are pigment granules. Four millimetres objective.

centimetre in width, one-half centimetre in thickness and three centimetres in length. The synovial membrane over this is only slightly hypertrophied and is less dark in color than are the villi.

The third specimen consists of a small block of cartilage two millimetres in thickness and five millimetres square with a bit of the attached synovial membrane and underlying bone.

Microscopical Examination.—Projecting from the synovial surface are many folds and villi. These are large and very numerous in the loose or areolar areas of the joint and are small and few in number or even absent in the dense fibrous areas.

The most striking feature in the sections is that the tissues, and especially those near the synovial surface, are loaded with granules and masses of yellowish-brown pigment.

Synovial Surface Layer.—Over most of the surface the synovial lining cells are moderately increased in size and number, forming a surface layer which is from four to ten cells in thickness. The majority of these cells are the moderately enlarged synovial lining or fixed connective-tissue cells. They range from spindle to stellate

or ovoid in shape and possess a faintly basophilic protoplasm and a rather deeply staining nucleus which is larger than that of normal synovial lining cells. Many of these cells contain a few or moderate number of the pigment granules. (Fig. 3.)

Scattered through the surface layer are great numbers of large phagocytic cells (macrophages), many of which are loaded with the yellowish-brown pigment. Many of these cells contain a large pale nucleus with one or more large neucleoli and are characterized by a sharply defined clear zone in the protoplasm on one side of the nucleus. This clear zone is roughly spherical in shape, like ground glass in appearance, and free from the pigment with which the rest of the cytoplasm may be loaded. It corresponds to the rosette of the monocyte, and these cells are believed to be monocytes. A few of the monocytes contain two nuclei and occasional mitotic figures are found in the connective-tissue lining cells.

In the dense fibrous areas of the joint the surface is composed of a layer of collogenic tissue and the cells are for the most part imprisoned in lacunæ and buried

FIG. 4.

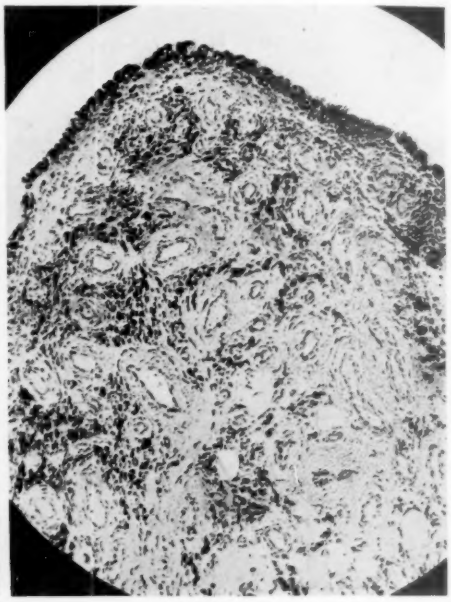

FIG. 5.

FIG. 4.—Fibrous areas of the synovial surface. Note that in the upper surface the cells are imbedded in lacunæ. Eight millimetres objective.

FIG. 5.—Vascular area of synovial surface. The dark material is blood pigment. Sixteen millimetres objective.

beneath the surface. (Fig. 4.) In spite of the fact that these cells are enclosed in lacunæ many of them are about twice as large as are synovial cells in similar situations in normal joints and are not only enlarged, but possess long processes, many of which extend up to the articular surface. None of these cells contains any of the yellowish pigment which is so abundant in the cells covering the areolar areas of the joint surface, nor is this dense tissue invaded by macrophages. In the transition zones between the fibrous and the areolar areas a few of the synovial cells contain minute granules of pigment.

Subsynovial Tissue.—In the loose or areolar areas of the joint surface the subsynovial tissue is extremely vascular and infiltrated with macrophages and contains large amounts of yellow pigment. (Fig. 5.) The ground work of this tissue is composed of rather coarse bundles of collagenic fibrous tissue separated by fat and areolar tissue. The macrophages are scattered everywhere through the tissue and

are in many places collected into masses. A large percentage of these macrophages are loaded with the yellow pigment. In addition to the macrophages there are a considerable number of small round cells or lymphocytes scattered through the subsynovial tissue and occasionally these are collected into small nodules similar to those seen in chronic arthritis, and sometimes these are perivascular in arrangement. The blood-vessels vary greatly in size and in the thickness of their walls. In many places the tissue is extremely vascular and wide blood spaces with very thin walls lie just beneath the layer of synovial lining cells. In other places the tissue contains large numbers of small thick walled arteries.

In addition to the blood-vessels the subsynovial tissue contains a large number of spaces which are lined by synovial lining cells. In the sections these spaces appear to be cysts in the subsynovial tissue, but examination of the gross specimen indicates that most, if not all, of the apparent cysts are really deep clefts in the subsynovial tissue

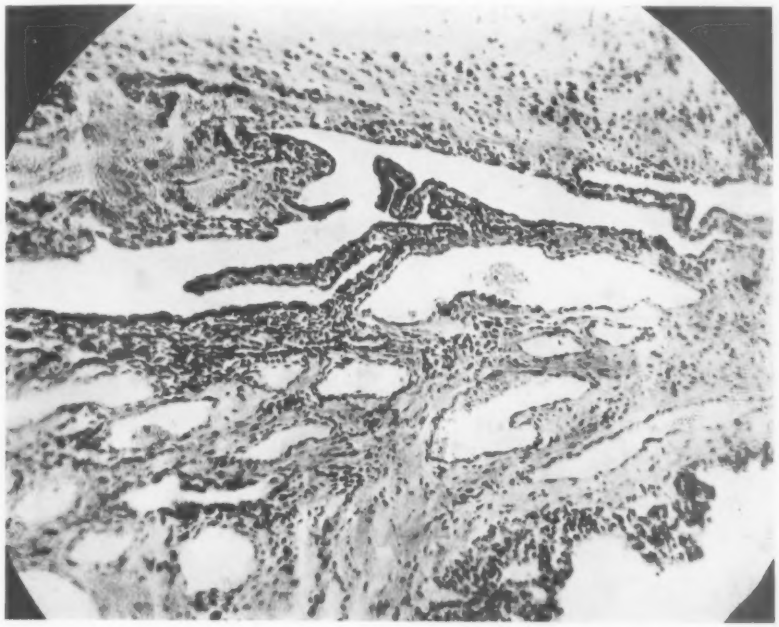

FIG. 6.—Cyst-like depressions in the synovial surface lined by synovial lining cells. These are believed to communicate with the joint cavity. Sixteen millimetres objective.

and that they communicate with the joint cavity and are lined by the same type cells as is the rest of the joint. (Fig. 6.)

The thickness of the layer of areolar subsynovial tissue varies greatly in different sections. In some places there is only a thin zone beneath the layer of lining cells (Fig. 7) while in others there is a wide vascular subsynovial layer. (Fig. 8.)

The subsynovial tissue rests on a layer of very dense collagenic fibrous tissue made up of bundles of fibres which run in various directions. The greater part of this dense fibrous tissue is not infiltrated by round cells or macrophages, but it contains occasional circumscribed areas into which the macrophages have penetrated and a few areas are seen in which the tissue is infiltrated by red blood-cells apparently the result of a recent hæmorrhage, and these are mixed with a moderate number of macrophages which are engorged with yellowish pigment.

Occasional clefts or possibly cysts lined by cells loaded with pigment granules penetrate deeply into the subsynovial fibrous tissue lying between collagenic bundles

and in other areas the tissue is made up of a mass of collagenic bundles which are separated by small blood-vessels and islets of engorged macrophages.

In the dense fibrous areas of the joint the collagenic fibrous tissue approaches or may even comprise the synovial surface and in these areas it is not infiltrated with macrophages.

The villi vary greatly in size and number and tend to resemble in structure the type of tissue from which they spring. They are most numerous in the loose areolar areas of the joint surface and here the villi are very complex in structure, containing many indentations and folds, and are extremely vascular and markedly infiltrated with macrophages. (Fig. 9.) In the areas where the subsynovial layer is very thin, the villi are short and slender and relatively simple in structure (Fig. 7), and in some parts of the dense fibrous area the villi are composed of dense fibrous tissue and contain no blood-vessels or macrophages.

FIG. 7.—Transition zone between areolar and fibrous type of synovial surface. Eight millimetres objective.

The yellowish-brown pigment which is scattered through the tissues is obviously blood pigment and gives a strong iron reaction. The greater part of this pigment is found in the bodies of the macrophages but a considerable amount is lying free in the tissue in masses varying from minute granules to conglomerates fifteen or more microns in diameter. In addition to the pigment in the macrophages minute granules of pigment are present in the fixed connective-tissue cells and in the connective-tissue cells making up the walls of the blood-vessels and even in the endothelial lining cells of both artries and veins in areas where the tissue contains large amounts of pigment. In other words, in such areas practically every type of cell present contains some of the old blood pigment.

Cartilage Margin.—The margin of the articular cartilage is overlapped by a layer of rather vascular synovial and subsynovial tissue. (Fig. 10.) This has invaded the cartilage for a short distance. The surface of the cartilage has undergone fibrosis and is invaded by vascular connective tissue. The synovial layer contains numerous small branching villi which are quite vascular and contain large numbers of macrophages

which are loaded with pigment. There is very little evidence of hyperplasia in the cartilage and the underlying bone is extremely atrophic so that in many places the cartilage practically rests upon the bone marrow and the cancellous bone of the epiphysis.

Later Condition.—June 10, 1931, the boy came in for an examination by request. At the present time he is fifteen years old, weighs 105 pounds and has just finished his first year of high school. He states that he has had no pain in the knee since leaving the hospital and that the operation has completely relieved his symptoms, with the exception of limitation of motion in the right knee. He walks three miles to school and during the past year he has missed only one-half day of school and this was because of a cold. He swims, plays ball, and does practically everything but skate. He still has a tendency to bruise after an injury, but this is not as severe as it used to be. Occasionally he hurts his fingers playing ball and they become swollen and painful for a few days, but the symptoms clear up spontaneously. From time to time he

FIG. 8.

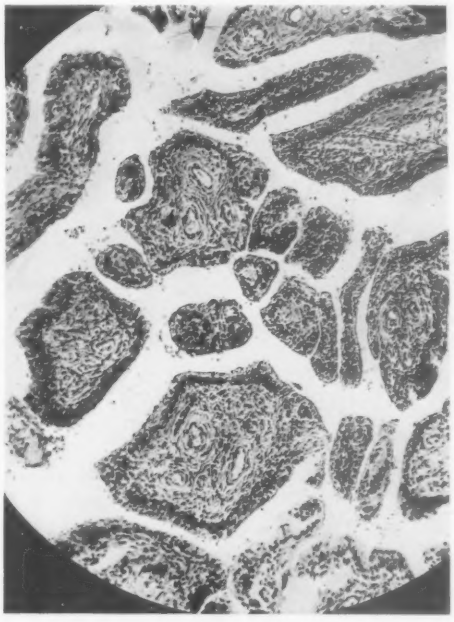

FIG. 9.

FIG. 8.—Areolar type of synovial surface. The large dark masses in the tissue are blood pigment and much of this is lying free in the tissue. Sixteen millimetres objective.
FIG. 9.—Cross-sections of multiple small vascular villi. Sixteen millimetres objective.

falls on his hands, and when this occurs the wrist, especially the left wrist, is apt to be swollen and painful for a few days, but this also clears up spontaneously. Six days ago he fell and injured his right hip. Two days later the hip became sore, stiff and painful and the hip is now in a position of flexion and he walks with considerable limp. He states that this is the first time that this hip has ever been injured and that up until this recent injury he was able to walk with scarcely a limp.

The patient is a tall, slender boy and apparently normal except for the right hip and right knee. (Fig. 11.) The right hip is flexed and moderately sensitive on movement. There is no swelling or external evidence of injury. The hip is slightly tender on deep palpation. There is permanent flexion of 60 degrees and flexion is limited to 90 degrees. Rotation is limited about 50 per cent.

The Right Knee.—There is permanent flexion of 25 degrees and the flexion is

limited to 90 degrees. There is a large, slightly tender scar over the anteromesial aspect of the knee and there is slight crepitus on motion. There is no pain in the knee with motion or weight bearing. There is some discoloration over the tibial tubercle which the patient states is due to a recent fall.

Blood-clotting time eight and one-half minutes by test-tube method (anything under fifteen minutes normal).

X-rays taken June 10, 1931, as compared with those taken before the operation, show decrease in the bone atrophy, disappearance of the thickened tissue around the internal condyles which was removed at the operation, increase in the size of the bones and slight increase in the irregularity of the articular surfaces. (Fig. 12.) An X-ray of the hip taken at this time is negative.

Historical.—The American literature on hemophilic arthritis is very meagre. With the exception of descriptions in text-books the only articles which I have found on the subject are those of Doub and Davidson,[2] Youmans,[3] and Wilson.[4]

FIG. 10.—Articular cartilage near the margin. The surface on the left is being invaded by vascular connective tissue while the subchondral bone on the right shows marked atrophy. Eight millimetres objective.

As the German and French literature has been reviewed by König,[1] Linser,[5] Zesas,[6] Du Pan,[7] Freund,[8] and Reineke and Wohlwill,[9] it will be considered only briefly in this paper. The older authors considered the joint affections in bleeders as being due to rheumatism and Volkmann is given credit for first differentiating the joint disturbances in hemophilics from rheumatism. In his text-book on diseases of the bones and joints published in 1868 he stated that spontaneous hemarthroses occurred in scurvy and hemophilia and that they might also result from trauma. The next year Reinert and Gasses expressed the opinions that bleeders' joints were due to intra-articular hæmorrhage.

The modern conception of the hemophilic arthritis dates from König's paper which appeared in the Klinische Vorträge in 1892. He divided the condition into three stages: (1) Hemarthrosis, (2) panarthritis, and (3) regressive stage, and warned against operation under a mistaken diagnosis.

Pathology of Hemophilic Arthritis.—The gross changes in the joints were accurately described by König and relatively little has been added to his original description. The microscopical changes in the synovial membrane are most completely described in the pathological description of the material in my case, which is included in this paper, and the microscopical changes in the cartilage and bone are most completely described in the papers by

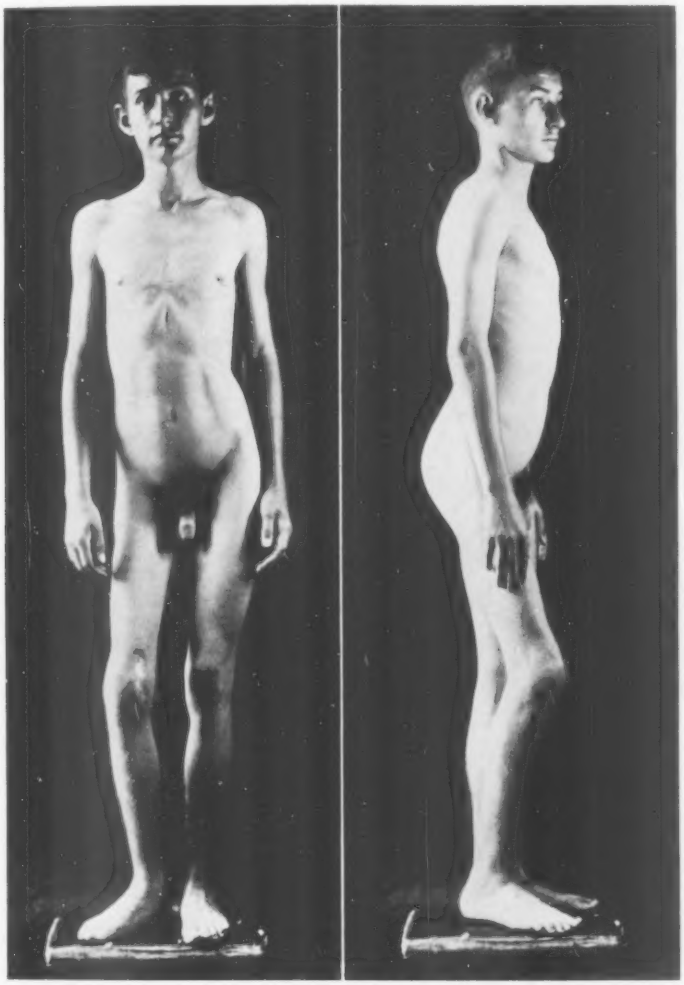

FIG. 11.—Photograph of patient one and one-half years after the operation. Note the flexion deformity of the right knee and a large scar over the internal condyle. When this photograph was taken there was an acute hemarthrosis in the right hip.

Freund[8] and Reineke and Wohlwill.[9] From the literature and my own observations the pathological changes can be described briefly as follows:

Changes in the Soft Tissues.—The hemophilic starts out with apparently normal joints. Due to some injury, or even without any known injury, bleeding into a joint may occur. This may begin early in life as in the case

illustrated in Fig. 13, where the first bleeding into the knee occurred at the age of two years and eight months. The joint becomes distended with blood under pressure which may be equal to the systolic pressure of the blood as the blood in the joint does not clot, at least not for a long time, and is in communication with that in the blood-stream.

In addition to its mechanical effect the blood in the joint acts as an irritant and hyperplasia of the synovial membrane occurs. As I have shown elsewhere,[10] a somewhat similar hyperplasia may be produced experimentally in animals by repeated injections of blood into normal joints. With this

FIG. 12.—X-rays of operated case one and one-half years after operation. Note the increased roughening in the joint and the decrease in the bone atrophy. The large rarefied area in the femur persists and the opaque synovial tissue which was removed at the operation is absent in the film.

synovial hyperplasia there is an accumulation of macrophages in the subsynovial tissues and these are constantly wandering back and forth between the joint cavity and subsynovial tissues.[11] These macrophages phagocytize the red blood-cells, become engorged with them, and as the red cells disintegrate the blood pigment remains in the body of the macrophages. These engorged macrophages settle down in the subsynovial tissues beneath the fibrous capsule of the joint and eventually die, thus setting free the blood pigment. This blood pigment may remain *in situ* or may be picked up by other macrophages. Eventually the bleeding ceases, the blood in the joint

is absorbed and the joint tends to return to normal, but in a hemophilic the bleeding recurs from time to time and with each recurrence there is an addition to the amount of blood pigment which is laid down by the macrophages in the subsynovial tissues.

Each new hæmorrhage is an added irritation to the synovial membrane and this hypertrophies with the formation of folds and villi. Not only is the blood pigment taken up by the macrophages, but, in the advanced cases, as I have shown in this paper, practically all of the cells in the vicinity contain some of the fine pigment granules. In other words, the area around the joint is saturated with blood pigment. While some of this enters the lymphatics and general circulation much of it remains permanently in the tissues around the joint just as does India ink when it is injected into joints.[11] An idea of the large amount of pigment which may be deposited in some of these joints is conveyed by the fact that in one of Freund's[8] cases in which the synovial membrane was analyzed for iron it was found that 71 per cent. of the ash was iron. Eventually, if the tendency to bleed ceases, the synovial membrane tends to return to a more nearly normal state, the synovial cells decrease in size and number, and the villi tend to atrophy.

FIG. 13.—Photograph of a severe hemophilic seven years of age with very severe contractures of both knees.

The accumulation of blood pigment in the subsynovial tissues and probably the repeated occurrence of bleeding into a joint under pressure serves as an irritant which results in the formation of a layer of dense fibrous connective tissue in the subsynovial tissue. In the case on which I operated this resulted in a marked decrease in the size of the synovial cavity and the subsynovial fibrous tissue envelope around the joint was distinct from the fibrous capsule of the joint and separated from it by thin areolar tissue. In such a case a tendency to fibrous ankylosis is present and this fibrous ankylosis is partly due to thickening and shortening of the fibrous capsule and ligaments, and partly to the production of new fibrous tissue in an abnormal situation. Not only does the new fibrous layer limit motion in the joint, but it also inhibits the resorption of blood from the joint cavity.

Changes in the Cartilage.—The cartilage probably remains normal for

a long time, but eventually it becomes eroded around its margins by the encroachment of the hyperplastic synovial membrane just as occurs in any infectious or atrophic arthritis. In addition to the marginal destruction there is a variable amount of spotty destruction of the cartilage over the articular surface of the bones. These areas of destruction are preceded by death of the cartilage cells and fibrosis and degeneration of the matrix. Whether this is the result of the blood in the joint or whether it is the result of subchondral hæmorrhages is not known. However, the cartilage destruction does not coincide with pressure areas in the joint and the destroyed areas are irregular in contour and have been described by König[1] as map-like in character. This map-like appearance is, we believe, characteristic of a hemophilic joint. Where the cartilage has been destroyed the underlying bone becomes covered with a layer of connective tissue and there may result a depression or cavitation in the bone which may be filled with a blood clot or organized hematoma or lined by connective tissue. There is little tendency for the production of connective tissue between the articular surfaces of adjacent bones and so far as we know bony ankylosis has not occurred in any hemophilic joint.

Changes in the Bone.—The characteristic feature in the bone is that the intra-articular portions of the bone may contain cavities. These cavities may be in the nature of simple depressions either on the sides of the intra-articular portions of the bones or in the articular surfaces, or they may occur deep in the cancellous bone. The origin of these cavities is not definitely known. Freund[8] and Reineke and Wohlwill[9] believe that they are the result of progressive erosion of the bone which is brought about in the same manner as is the bone destruction by an aneurism. That is, they believe that the increased intra-articular pressure is a very important factor in the production of the cavities and that the underlying bone is gradually eroded by the pressure of the blood in the joint. In addition to this they believe that hemophilic blood exerts some as yet unknown chemical effect upon bone which results in its rapid absorption.

In support of this theory Reineke and Wohlwill[9] describe the marked erosion of the cortex of the femur which occurred beneath a subperiosteal hematoma from which the patient died and in which the autopsy specimen was carefully studied and described. I do not know whether either or both of these theories are correct. It seems to me, however, that the most plausible explanation of the bone destruction with cavitatian is that it results from intra-osseous hæmorrhage. As we know, the bone destruction does not occur until late in the disease. At some stage of the disease the bones become markedly atrophic as a result of disuse. It seems quite probable that intra-osseous hæmorrhage may be a fairly common phenomenon in atrophic bone and may result from ordinary use without definite trauma. In a hemophilic such an intra-osseous hæmorrhage would tend to progress and result in the production of an area of aseptic inflammation in the involved area, and this

in turn would tend to result in the absorption of the bone by the inflammatory tissue. Whether or not this theory is true we do not know.

The areas of bone destruction are frequently so extensive that they are clearly visible in the X-ray and when present are characteristic of advanced hemophilic arthritis. Not only are they present in the interior of the bone, but there is a subperiosteal erosion of the bone which results in a pseudo-lipping due to the undermining of the articular margins. Occasionally, as a result of loss of cartilage on the articular surface,[12] true marginal osteophytes or exostoses may occur in these joints, but these are relatively rare. If, as the patient grows older, the tendency to bleed into the joint becomes less or ceases there may result a joint which closely resembles that of the ordinary hypertrophic arthritis. On the other hand, with repeated bleedings and progressive destruction of the articular surface marked deformities may occur.

Clinical Picture.—The clinical picture varies with the stage of the process and most authors follow the classification of König, who recognized three stages: (1) Hemarthrosis, (2) panarthritis resembling tuberculosis, and (3) regressive stage with erosion of the joint borders. I am not able to separate the panarthritic from the regressive stage and do not think that this has been done successfully by König or any other author whom I have consulted. Consequently, only two types of bleeders' joints will be recognized: (1) Acute hemarthrosis and (2) chronic arthritis.

(1) *Stage of Acute Hemarthrosis.*—This is the stage of acute hæmorrhage into a joint which in other respects may be practically normal or may be the site of a chronic hemophilic arthritis. The joint disturbances in hemophilia nearly always begin in childhood and the surgeon may see the patient during the first attack, but it is usually possible to obtain a history of similar attacks in the involved joint or in other joints, and it will be found that these previous disturbances either cleared up spontaneously or after a few days' rest and that the involved joints returned to normal or a chronic arthritis developed. The joint disturbance may have occurred spontaneously, even while the patient was asleep in bed, but in most instances it will have followed a minor injury such as a contusion or unusual strain.

It is characteristic for the effusion to appear rapidly and marked swelling may occur within a few minutes so that the patient may even see the joint swell, as sometimes occurs in acute Charcot joints. In some instances the swelling is a very gradual process and may progress slowly over a period of several hours or days. The degree of swelling ranges from a joint containing a slight amount of excess fluid to one which is extremely tense and distended with fluid under considerable pressure. (Fig. 14.) In a case cited by Reineke and Wohlwill[9] the intra-articular pressure was so great that the blood spurted over two neighboring beds when a needle was inserted into the knee.

Pain may be slight or intense and tends to vary directly with the degree of swelling and pressure within the joint. The same is true of the func-

tional disability. These joints vary from those with slight swelling and no limitation of motion or pain on motion or even on weight bearing to those which are greatly swollen, very tense and painful, and in which weight bearing is prohibited by pain and practically all motion is prevented by pain and muscle spasm.

On physical examination the patient is usually a slender, pale, anæmic-looking male and presents nothing remarkable except the involved joint. The findings in the involved joint vary with the amount of the intra-articular hæmorrhage and the tension on the capsule. If the amount of excess fluid is not great the joint may show only slight swelling and in the case of a superficial joint the signs of excess fluid in the joint are present. If the

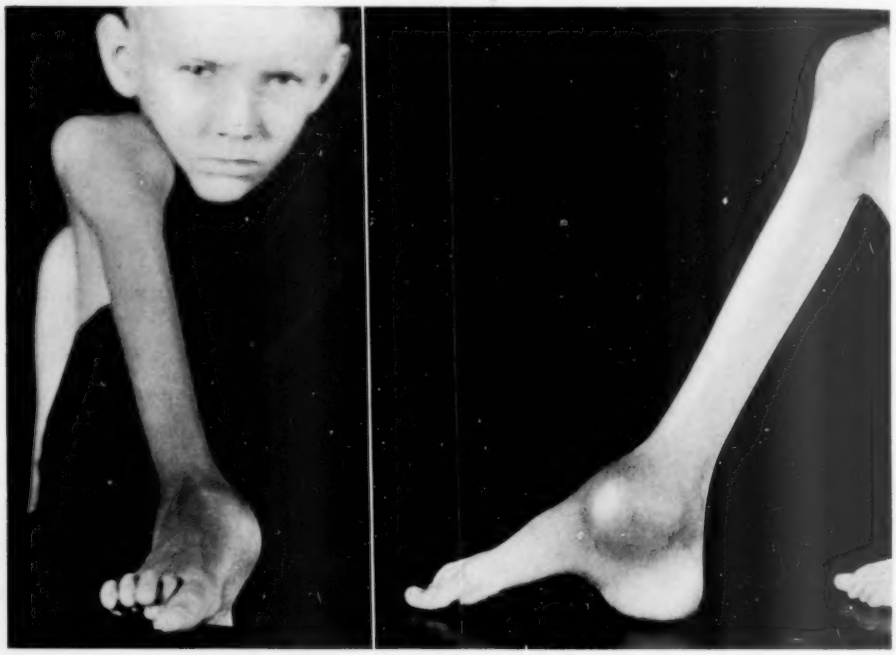

FIG. 14.—Acute hemarthrosis in right ankle. Same case as preceding.

blood is present under pressure the joint may be markedly swollen and acutely tender and the tenderness may extend up and down the limb. (Fig. 14.) Local heat and redness are not present, but a joint which is covered by a relatively thin layer of tissue such as a finger or an ankle-joint may be definitely blue (cyanotic) in color.

In the severe cases the joint is fixed in a position of moderate flexion by muscle spasm and both active and passive motions are limited. There may be some local heat, but redness and œdema are not present. As a rule the bleeding is into the joint and the swelling follows the outline of the synovial cavity, but there may be more or less extra-synovial hæmorrhage and in such cases dark bluish areas may appear in the subcutaneous tissues near the joint. These subcutaneous discolorations resemble the bruises which are so

frequent in hemophilics and are most evident three or four days after the beginning of the joint bleeding. Unless the joint is involved in a chronic arthritis there is no muscle atrophy or deformity other than that incident to the muscle spasm in the severe cases.

The temperature tends to be slightly elevated and in exceptional cases may reach 39 or 40 degrees C. and there is usually a moderate leucocytosis, but the prostration found in acute infectious processes is absent.

In the röntgenogram the bones tend to be normal, but the joint cavity is distended with fluid and this, being blood, casts a shadow which is rather more dense than that usually seen in acute synovitis.

(2) *Chronic Arthritic Stage.*—This may be defined as the stage in which the involved joint fails to return to an apparently normal condition after the hæmorrhage. It may follow the first hæmorrhage into the joint, as occurred in the knee of the operated case reported in this paper, but this is unusual, and permanent changes in the joint do not ordinarily occur until after several such attacks. A rather extreme case is that reported by Gocht,[13] in which hemarthrosis of one knee had occurred forty-five times, but the blood had always been resorbed and normal function restored.

In the arthritic stage it will be found that after an acute hemarthrosis the joint remained swollen, tender, sore, and painful for several weeks or months and that there is more or less permanent disturbance of function with a tendency to repeated attacks of acute swelling and pain which are usually the result of minor injuries. It should be pointed out that this stage resembles ordinary chronic arthritis in that it tends to progress by remissions. That is, the joint quiets down after an acute attack and there is more or less restoration of function, but the joint is not so good as it was before the attack and with recurring attacks there is an increased permanent disability.

During an acute attack in the arthritic stage the joint is swollen, painful, tender, and disabled as in the stage of hemarthrosis. The difference between the two stages is that in the arthritic stage the swelling tends to be less because it is limited by the subsynovial fibrous tissue and the blood in the joint is not resorbed promptly, and contracture, deformity, peri-articular thickening and muscle atrophy are present and tend to increase after each fresh hæmorrhage.

After the acute hæmorrhage has subsided, the muscle atrophy, deformity, limited motion, and disability persist. The joint is more or less swollen and this is partly due to a small amount of excess fluid (blood) which is almost constantly present in these joints, but largely to thickening of the periarticular tissues. This thickening follows the outline of the synovial cavity and on palpation the indurated subsynovial tissue may be felt. In addition to the above there may be more or less actual thickening of the bones entering into the joint and this may be general or local from the ossification of old subperiosteal hematomas.

In the regressive stage of König the tenderness and pain on motion have

largely disappeared, but there is soft crepitus on motion and the amount of motion is more or less limited. In severe cases there may be fibrous ankylosis with practically no motion in the joint, but I know of no case in which true bony ankylosis has occurred.

The most severe deformities which I have seen in hemophilic arthritis are illustrated in Figs. 13 and 15. This seven-year-old boy is a severe familial hemophilic and trouble with the knees began at the age of two years. On admission there was permanent flexion of 90 degrees in one knee and of 110 degrees in the other. On account of the deformities the patient has not walked for over five years. The parents did not wish us to attempt to

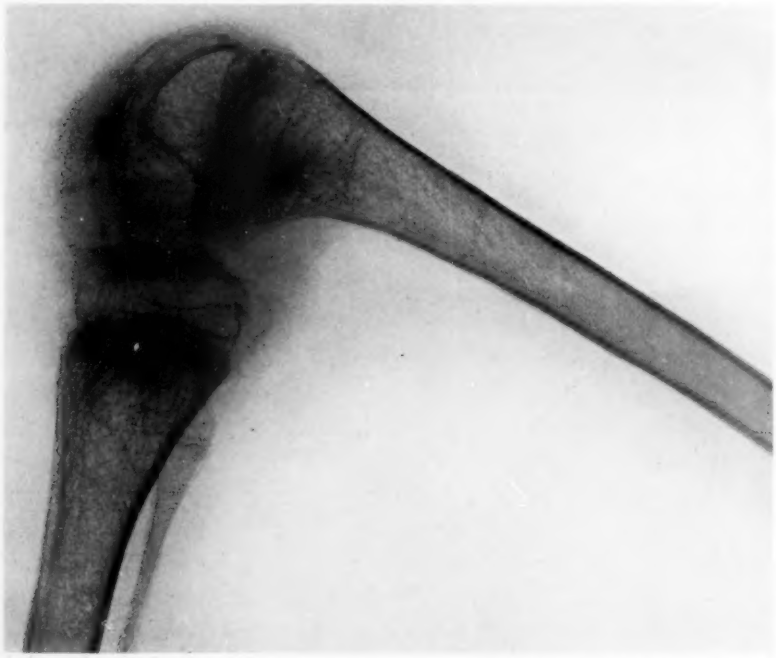

FIG. 15.—X-ray of knee-joint of preceding case. Note the marked atrophy in the bones, roughening of the joint surfaces and cloudiness of the joint capsule.

straighten the knees, but brought the boy to the Shriners' Hospital because of the acute hemarthrosis of the ankle. (Fig. 14.) A few days after his admission, while lying in bed the patient developed acute hemarthrosis in one elbow, and one finger and a moderate hematoma behind one ear and a very large hematoma (about five by ten inches) on the back and right shoulder. All of these were present at one time.

The knees of the above case resembled those of a typical case of Still's disease (atrophic, rheumatoid, or chronic infectious arthritis). The knee of my operated case resembled a traumatic arthritis and the knees of the man whose X-rays are shown in Figs. 16 and 17 resembled a hypertrophic arthritis. During the intervals between attacks this man had relatively little disability and on physical examination the knees presented only moderate

periarticular thickening and soft crepitus on motion and slight limitation of motion.

It is thus evident that the chronic hemophilic joint may present a very variable clinical picture and that these chronic joints are subject to acute hæmorrhages which result in periods of marked disability (panarthritis of König) which may be prolonged or clear up within a week or two and that after these acute symptoms have cleared up the joint returns to the original relatively painless chronic arthritic stage (regressive stage of König). But the acute symptoms may return at any time. As the patients grow older the hæmorrhages tend to become less frequent. For instance, the man whose knee is shown in Figs. 16 and 17 now goes two years or more without trouble, whereas during childhood he had several acute hemarthroses a year, and the same is true of my operated case.

The temperature and blood picture tend to be normal except during an acute hæmorrhage into the joint when there may be more or less fever and a moderate leucocytosis. The blood-clotting time tends to be prolonged to a variable degree.

Röntgenographical Appearance.—The X-ray findings have been described by Gocht,[13] Mermingas,[14] Hubscher,[15] Neumann,[16] Mankiewicz,[17] Rhonheimer,[18] Montonari,[19] Engels,[20] Dun Pan,[7] Petersen,[21] Carry,[22] Freund,[8] Doub and Davidson,[2] and Reineke and Wohlwill.[9] In the acute hæmorrhagic stage there are no changes in the bones, but the blood in the joint casts a shadow which is slightly more dense than that of the usual synovial effusion.

In the arthritic stage the X-rays reveal abnormalities in the soft parts and bones which have been variously described as resembling the changes produced by tuberculosis, hypertrophic arthritis, atrophic arthritis, or traumatic arthritis. As a matter of fact, while they may present some of the changes found in any of the above conditions the röntgenograms of a typical case of hemophilic arthritis may present characteristic features which make it possible to make the diagnosis from the X-ray alone. These features are a markedly increased density of the synovial tissues and crater-like depressions or punched-out defects in the intra-articular portions of the bones. However, many cases do not present these characteristic features and these cannot be diagnosed by the X-ray alone.

The increase in density in the synovial tissues often takes the form of definite shadows resembling areas of calcification. These shadows are present in the recesses of the joint and follow the outline of the synovial cavity. A careful examination of the affected knee-joints in our operated case gives one the impression that the synovial membrane is thickened and more or less calcified. These shadows are much more definite and sharply outlined than is the cloudiness of the joint space in tuberculosis and are more regular in outline and general in distribution than are the extra-articular calcified masses in Charcot joints. In addition to the above the patella may float on account of effusion into the joint and the patellar tendon may be bowed forward by the fluid or hypertrophied fat pad beneath it.

Fig. 16.

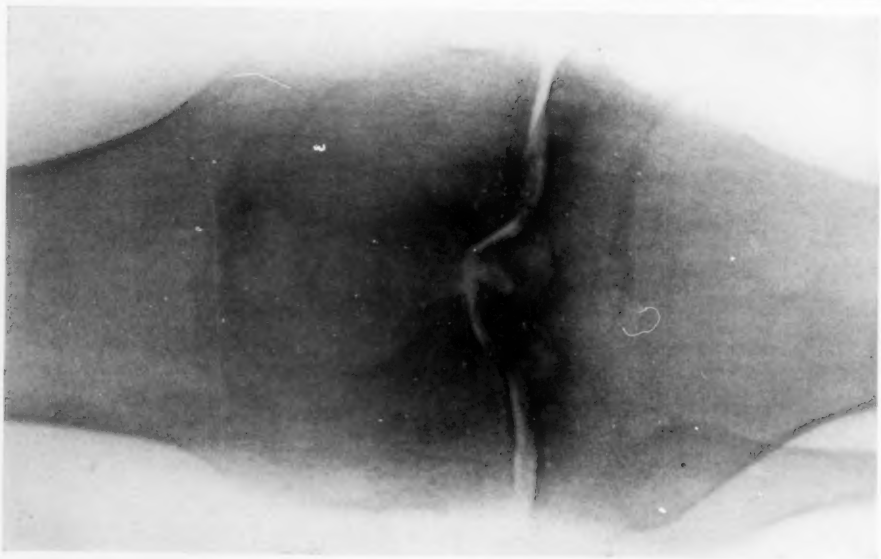

Fig. 17.

Fig. 16.—X-ray of knee-joint in a man forty-one years old. Chronic hemophilic arthritis. Note the resemblance to chronic hypertrophic arthritis.

Fig. 17.—Lateral view of same case as preceding. Note the cloudiness in the joint capsule and the punched-out area in the articular surface of the patella

The joint space is narrowed to a variable degree and may be obliterated, but bony ankylosis apparently does not occur. The articular surfaces of the bones are more or less irregular and indented and the ends of the bones entering into the joint are more or less deformed. In the knee the condyles, especially of the femur, may be broadened or less broad than normal. A rather characteristic picture is one in which the sides of the condyles of the femur and tibia present definite hollowed-out defects just above or below the articular margin giving one the impression of border osteophytes. And border osteophytes have been described in these joints, but they are quite unusual. In knees presenting these lateral defects the notch between the femoral condyles is usually broader and deeper than normal and the spines of the tibia are apt to be deformed. There may be considerable new bone formation from the calcification of a subperiosteal hematoma and this is especially apt to occur in the elbow. In the hip the head of the femur may be deformed in such a manner that the X-ray picture resembles that of Legg-Calve-Perthes' disease (osteochondritis deformans juvenilis).

Many authors have described atrophy of the bones, and this is generally present (Fig. 15), but if the arthritis is quiescent and the patient has been using the extremity for some time the bones may be of approximately normal density. (Figs. 16 and 17.)

The characteristic rarefied areas are described by Engels[20] as opening into the joint with crater-like formations, but they may be deep in the bone and well removed from the joint space, and here they resemble the punched-out areas such as are produced by myeloma or metastatic carcinoma. In my cases they have been surrounded by a shell of bone which is slightly more dense than is that in the vicinity. They may be present in elbows and other joints, but are most marked in the knees.

Diagnosis.—It is not especially difficult to arrive at a correct diagnosis if the surgeon thinks at all of the condition. The great difficulty is that the possibility of encountering a hemophilic joint does not occur to the surgeon and he may not learn that the patient is a bleeder until after the joint has been opened. At least this has been the state of affairs in most of the cases in the literature which were operated upon and died from hæmorrhage following the operation (König,[1] Tillmann,[23] Zielewicz,[24] Froelich,[25] Zesas,[6] and others). As a rule, these patients were orphan boys.

In my case the operation was the result of operating upon a patient after a casual examination, the diagnosis having been made by others. However, unless I had obtained a history of hemophilia I do not believe that I would have suspected a hemophilic arthritis in my case and would have operated just the same, as my knowledge of the subject was very casual until my error caused me to study it.

In the Stage of Acute Hemarthrosis.—This is to be differentiated from traumatic synovitis, acute rheumatic fever, acute pyogenic arthritis, gonorrhœal arthritis and osteomyelitis.

The most characteristic feature of an acute hemophilic hemarthrosis is the

sudden onset and rapid progress of the condition either spontaneously or after a mild injury. If the injury has been severe enough to lead the surgeon to suspect a traumatic synovitis, the swelling and effusion into the joint will occur more rapidly and will be greater than one would expect to find after such an injury and the joint capsule will be unusually tense and the patient will complain of pain even when the joint is at rest.

In acute rheumatic fever, acute pyogenic arthritis and acute osteomyelitis, the onset is more gradual and the pain is the first symptom while the swelling comes later. Likewise, in these conditions the temperature is apt to be higher, 103° or more, and the leucocyte count is usually elevated above 15,000. In hemophilic hemarthrosis the temperature and leucocyte count are as a rule only moderately elevated (100° to 101° and 10,000 to 12,000 white blood-cells).

In all of the above conditions there is usually some increase in the local temperature, but in hemophilic hemarthrosis the skin over the involved joint is normal in temperature and color unless it has been injured, but may appear cyanotic if the joint is close to the surface, while in the other conditions there is usually more or less redness of the skin.

Gonorrhœal arthritis resembles an acute pyogenic arthritis except that the onset is usually more gradual and the general and local symptoms are more mild in character. The gradual onset will usually distinguish it from a hemophilic hemarthrosis and in addition one may obtain either a history or physical evidence of gonorrhœa.

From what has been said above, the diagnosis may seem comparatively easy and yet if one be confronted with a flexed hip in which all motions are limited by muscle spasm and which is acutely painful, tender, and sensitive and the patient has a temperature of 102.5° F. and a white blood-cell of 15,000 and gives a history of having been perfectly well the day before one is not apt to think of hemophilic hemarthrosis, which may be the condition present, and such hips have been operated upon and fatal hæmorrhages have resulted.

The most important diagnostic feature is the history, and most hemophilics know that they are bleeders and will tell the surgeon so, or their families know it and will volunteer the information and it is thus that many surgical catastrophies have been averted. As was stated above, most of the operated cases have been young orphan boys.

In any joint condition it is always advisable to inquire whether or not a similar condition ever occurred in the affected joint or in other joints. And in the hemophilic this question will usually be answered in the affirmative because most of these patients have had hemarthroses in various joints from time to time and will usually tell the surgeon that the symptoms tend to clear up after a few days' rest. Such a statement made by a pale, slender boy should always lead the surgeon to suspect and rule out hemophilia by a careful history and accurate determination of the coagulation time of the blood.

Finally, the diagnosis must be made by the history and a determination of the coagulation time of blood, and this is most accurately done by the test-tube method. However, it is to be emphasized that a normal coagulation time does not rule out hemophilia as the coagulation time undoubtedly varies from time to time in hemophilics. For instance, by the test-tube method under fifteen minutes is considered normal. In my operated case the coagulation time varied from seven and one-half to eight and one-half minutes.

In suspected cases the joint should be aspirated with a small needle and if blood is obtained and acute traumatic synovitis can be ruled out, the diagnosis of hemophilic hemarthrosis is fairly certain.

In the Stage of Chronic Arthritis.—The symptoms may be severe or relatively mild depending upon whether or not an acute hæmorrhage has recently occurred in the joint. In the relatively quiescent state during the interim between acute attacks the joint is moderately swollen and the swelling is found to be largely the result of periarticular thickening, but the joint may also contain a small amount of excess fluid. There is no local heat or redness and the joint is not, as a rule, especially tender. There is a variable degree of flexion deformity and motion is limited, but ankylosis is not present. Function of the joint may or may not be painful and there is moderate atrophy of the muscles of the limb.

With an acute hemarthrosis the symptoms resemble those of that stage as described above. After a period of time which may last for several weeks these acute symptoms gradually subside and the joint returns to the relatively quiescent state as described above and this may last for months or years and the patient be relatively free from symptoms until a fresh hæmorrhage occurs in the joint.

The X-ray shows narrowing of the joint space, a variable amount of erosion around the articular margins and a variable amount of bone atrophy with cloudiness of the joint area due to the shadow cast by the non-bony contents of the articular capsule.

The above descriptions might serve equally well for chronic tuberculosis of the given joint and almost as well for certain low-grade monarticular arthritic conditions of traumatic or unknown etiology. As a matter of fact, most of the cases which have been operated upon were operated upon with the erroneous diagnosis of tuberculosis.

How, then, is one to differentiate the chronic hemophilic joint? An accurate history of the onset and course of the disease is the most important factor in the diagnosis. In the hemophilic joint the onset of the trouble can always be traced back to an acute swelling of the joint which may or may not have followed an injury and there will be a history of many such episodes. Usually there will have been several attacks of hemarthrosis before the true chronic arthritis began, the joint having returned to a normal condition after the earlier attacks, but occasionally, as in my operated case, the arthritis may date from the first attack. In such cases one can obtain a history of repeated acute attacks since the onset of the arthritis and the patient will state that the

acute symptoms subsided after a few days' rest. And in addition to the chronic arthritis, which may be monarticular or involve two or three joints, there is a history of milder disturbances in other joints.

Such a history should lead the surgeon to suspect a hemophilic joint. Of course, if the surgeon should learn that the patient is a bleeder, the diagnosis is clear. If there is a history of abscess formation in the joint, hemophilia may be ruled out as these joints do not suppurate.

An important point in the X-ray diagnosis is that the shadow cast by the thickened synovial tissues and capsule is more dense and sharply defined than is the case with any other type of arthritis with which I am familiar. However, I have seen X-rays of hemophilic arthritis of many years' standing in which the X-ray picture closely resembled that of chronic hypertrophic arthritis, and Petersen[21] reports cases in the hip which closely resembled old Legg-Calve-Perthes' disease (osteochondritis deformans juvenilis). The areas of rarefaction in the depths of the cancellous bone which are regarded as pathognomonic by Engels[20] are not always present and it should also be noted that such areas may occasionally be seen in tuberculosis or in arthritis from other causes. Consequently, one must conclude that in many, and perhaps in the majority of cases the diagnosis cannot be made from the X-ray alone. In my operated case the röntgenologist's diagnosis was chronic arthritis and a calcified hematoma.

In case a hemophilic arthritis is suspected, the clotting time of the blood should be ascertained in order to confirm the diagnosis; but, as was stated above, this may be misleading.

Treatment of Acute Hemarthrosis.—With acute hæmorrhage into a large joint rest to the involved joint is indicated and if necessary the patient should not only be put to bed, but the joint should be splinted or even immobilized in a plaster-of-Paris bandage until pain disappears and the blood in the joint cavity is largely absorbed. There is also the question as to whether or not these joints should be aspirated. At times they are intensely painful and in such cases aspiration has been carried out without ill effects. However, this is not a procedure without a certain amount of danger, as illustrated by the case of Petersen[21] in which the joint was aspirated and then continued to bleed from the puncture wound until it eventually became infected and the patient died with a streptococcus infection. Consequently, if aspiration is decided upon it should be done with the full understanding on the part of the patient or the patient's parents that it is not without a certain amount of risk and the aspirating needle should be of very small bore. On the other hand, in my case after operation, aspiration with a twenty-two-gauge needle was done on three separate occasions with no ill effects, but at that time in my case the blood-clotting time was within normal limits.

When the swelling disappears from the joint, function may be resumed, but the patient should be cautioned against indulging in activities which would tend to result in traumatism of any sort.

Chronic Hemophilic Arthritis.—In the chronic stage of the disease the

treatment may be divided into two phases: (1) The correction of deformities, and (2) support of the involved joint.

Correction of Deformities.—Most of these knee-joints, and occasionally other joints, develop severe deformities as in the case illustrated in Fig. 13 in which the flexion contracture of both knees is beyond 90 degrees. In the majority of cases, however, the deformities are not so severe. No attempt should be made to correct these deformities unless the deformity is a definite handicap to the patient. If this is true the deformity should be corrected by conservative means and operations upon the joints should not be done. In other words, the deformities may be corrected by traction or by wedging plasters or by mechanical appliances in which by means of pressure and counter-pressure with or without traction the contracted tissues are gradually stretched and the joints are straightened. After the deformities have been corrected the limb must be maintained in the corrected position over sufficient time to prevent recurrence.

Support to the Involved Joints.—As a rule these joints are not painful except during the stage of acute disability, and no support is necessary. Occasionally, however, in the case of a knee or an ankle, an elastic bandage may give the patient considerable comfort. Very rarely is a supporting splint such as a Thomas walking caliper indicated.

Severe Hæmorrhage.—In the great majority of instances the bleeding into a joint is not sufficient to materially deplete the blood volume of the patient and tends to cease spontaneously with rest. However, alarming or even fatal hæmorrhages may result from accidents or operations and subcutaneous hematoma of great size may occur spontaneously. In such cases it is imperative that the blood coagulation time be reduced to normal. There are various preparations on the market which tend to hasten the coagulation of the blood, but in a surgical emergency reliance is to be placed on a transfusion of whole blood from a matched donor. This is the method of choice as it not only reduces the coagulation time of the blood, but also restores the blood lost by the hæmorrhage.

The Hemophilia.—At the present time we have no acceptable treatment for this condition. In a recent communication by Birch[26] it is shown that the failure of the blood to clot is due to an abnormal toughness of the blood platelets in that they are highly resistant to hypertonic salt solution and fail to disintegrate when the blood is shed. Since hemophilia does not occur in the female, Birch[26] has treated two cases with ovarian extract and has reported that the tendency to bleed has been controlled by this method for periods of eleven and five months respectively.

This is not a new idea as some years ago, while working at the Boston Children's Hospital, I administered ovarian extract to two hemophilics under the direction of the late Dr. James S. Stone, who was then Chief of the Surgical Service. So far as we were able to determine in our cases the ovarian extract made no difference in the condition. It is possible that we did not use the right product.

On the other hand, it should be pointed out that the degree of hemophilia varies from time to time in given patients and while the report of Birch is important and the method should be tried we reserve our opinion until further cases have been reported and these cases have been followed over a longer time. In our operated case, as stated, we were able to obtain a large increase in the number of blood platelets by the administration of irradiated ergosterol. Whether or not this increase in the number of blood platelets will result in materially shortening the clotting time has yet to be determined.

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CONGENITAL CYSTS AND FISTULÆ OF THE NECK

By Herbert Willy Meyer, M.D.

of New York, N. Y.

(continued from page 26)

Case Reports.—Case I.—Miss M. P., aged thirty-one, single, July, 1931. Referred by courtesy of Dr. Francis Huber, Jr. On the right side of her neck was a small swelling which began to be evident in October, 1930. It was very small at that time. Since then

Fig. 24.—Author's Case I. Lateral cyst of neck. Showing patient before and after operation. Also cyst and microphotograph of section of cyst wall with squamous epithelium lining.

it had grown constantly. There was no pain, no fever. Family history negative. All other findings negative. Examination showed a cyst-like swelling about the size of a large egg, seemingly under the anterior border of the right sternocleidomastoid muscle. There was no evidence of any surrounding inflammatory reaction. A differential diagnosis of a tuberculous lymph-node or a lateral cyst of the neck or an aberrant thyroid cyst was made.

Operation was performed at the Lenox Hill Hospital July 15, 1931. A two-inch incision was made along the anterior border of the sternocleidomastoid muscle. After dividing the platysma and entering the space beneath the sternomastoid muscle, a solitary cyst was found lying external to the lateral lobe of the thyroid. It was easily enucleated and the wound closed with a small drain. Convalescence was uneventful. Microscopical examination showed the cyst to be lined with flat epithelium with lymphoid tissue in the wall. The contents of the cyst were clear. There is no question in my mind but that in this case we were dealing with a cyst which was a rest of the thymus duct; it must therefore be classified as a lateral cyst of the neck. (Fig. 24.)

Case II.—K. D., male, aged twenty-seven, May, 1925. Referred by courtesy of Dr. Emanuel Baruch. This young man had had a small opening at the lower end of the neck on the left side since the time of his birth, from which secretion had come out from time to time. It had never bothered him until five months previously when a larger swelling appeared on the left side of the neck, and the secretion that come out from the opening increased in amount and was of an extremely foul odor. When squeezing the swelling the patient noticed that the secretion also at times entered the back of his throat with a bad odor and bad taste. Otherwise he was perfectly well. General examination was entirely negative except for three sebaceous cysts of the scalp. *Local Condition.*—At the lower end of the anterior border of the left sternomastoid muscle there was a small opening surrounding which the tissues were somewhat infiltrated and tender. This was the result of and had occurred within the last two days following the injection of bismuth oil to take an X-ray picture in order to outline the tract. Just above the opening of the fistula there was a swelling about the size of a hazelnut which was also moderately tender. Examination of the throat showed that both tonsils were enlarged and cryptic. Diagnosis was congenital complete lateral cyst and fistula of the neck.

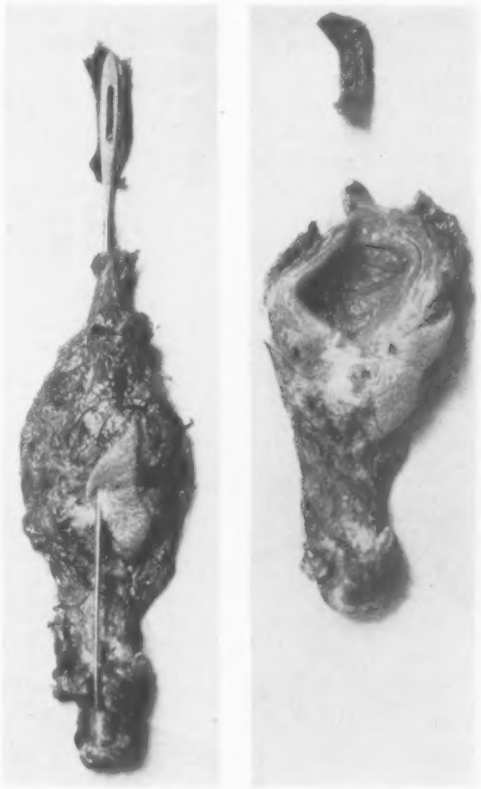

Fig. 25.—Author's Case II. Specimen of complete lateral fistula and cyst removed by operation. The inner end of duct shown as separate specimen was completely removed according to the technic of von Hacker. Picture on left shows specimen as removed, that on the right shows same specimen layed open to show lining of cyst and duct.

Operation was performed at the Lenox Hill Hospital May 23, 1925, under general anæsthesia. An incision was made along the anterior border of the sternomastoid muscle, surrounding the fistula and including a little of the skin. The skin was reflected carefully, freeing it from below from the bismuth which had infiltrated into the tissues. The infiltrated area was treated as a tumor and removed with the cyst, which could be nicely isolated and dissected free from the underlying middle cervical fascia. After the cyst was freed the duct could be seen passing upward toward the cornu of the hyoid bone, and from here passing inward under the posterior belly of the digastric muscle. This duct was isolated as far as possible by blunt dissection from the surrounding tissues and then a clamp was placed just above the cyst. The

cyst and tumor part of the specimen were then removed. A small nick was now made into the duct permitting a probe to be introduced which, when pushed along the duct, entered the pharynx through the left tonsil close to the posterior pillar. The probe was then pulled through until the eye of the probe was within the duct. A suture was now placed through the duct, through the eye of the probe and again through the duct, and this was securely tied around the duct after pulling the probe so far that the suture would come to lie at the very upper end of the eye of the probe. The clamp was now removed and by pulling on the probe through the pharynx the entire duct was easily everted into the pharynx remaining attached to the point where it emerged through the tonsil. Here it was separated by sharp dissection and thus completely removed. (Fig. 25.) The neck wound was disinfected with 5 per cent. iodoform in ether and the wound sutured with interrupted silk. A small split rubber drain was placed in the region where the duct passed in toward the pharynx.

Comment.—The wound healed without any trouble and the patient has remained well. From the above description there is no question in my mind but that this cyst and complete fistula exactly coincided with the course of the thymus duct, and must therefore be classified as a complete lateral fistula and cyst of the neck.

CONCLUSIONS

(1) Five or six arches and clefts are present in human embryos. The clefts are not open.

(2) The sinus cervicalis is bounded by the third arch, the lateral border of the neck and the chest. The second arch plays no part.

(3) The branchial apparatus lies from before backward and not from above downward. The lowest limit of the apparatus or structures that develop from it is formed by a line running through the hyoid bone.

(4) Branchial apparatus disappears in the beginning of the second embryonic month. Only squamous epithelial rests, sometimes cartilaginous rests, can remain behind as parts of it. These are above and dorsal to the hyoid bone. Below the hyoid no rest of the branchial apparatus can remain behind.

(5) The thymus develops from the third pharyngeal pouch and is a long canal running obliquely from the lateral pharyngeal wall down to the sternum. Here the thymus gland substance itself begins to develop.

(6) The thymus canal retrogresses. It may persist throughout life or segments of it may persist which are usually in the lower portion.

(7) The thymus canal rests may form a fistula or a cyst. If the canal persists, a complete fistula will result.

(8) Lateral fistulæ coincide with the thymus canal in direction, in histological findings, and the walls may be covered with squamous epithelium, flat epithelium, but ciliated cells may also appear.

(9) The lateral thyroid lobes also have a short lateral canal that disappears early in embryological life. It is analogous to the thymus canal and would make one believe that this canal could persist, and that a fistula or cyst might develop. Inner opening would be near opening into the glottis.

PART II. MEDIAL CYSTS AND FISTULÆ OF THE NECK

Kostaniecki and Milecki were the first to clarify the massive literature on this subject. However, they made an error in that they accepted Rabl's theory, which taught

that the second cleft was very long and narrow, and served as excellent material for the development of these fistulæ. They attributed the medial fistulæ to the second branchial cleft. His disproved this theory and showed that the middle lobe of the thyroid played an important part in the formation of the mid-line cysts and fistulæ. The passage from the foramen cæcum of the tongue and the middle lobe of the thyroid was called the "ductus thyroglossus" by His. Marchand confirmed His's belief clinically by a careful autopsy of a child with a medial fistula. The fistula went upward close to the hyoid. Then it became a strand closely adherent to the periosteum of the hyoid. Close to the tongue the strand became a canal again, which opened at the foramen cæcum of the tongue.

This theory has been generally accepted by all surgeons. However, certain clinical findings, according to Wenglowski, still remained unexplained: first, the microscopical findings of the lining of the fistula, namely, once squamous epithelium, then ciliated epithelium; second, why the fistulæ sometimes pass through the hyoid bone; third, why they are never actually complete fistulæ.

In order to elucidate these three problems, Wenglowski decided to closely examine the development of the mid-thyroid lobe.

In the 2.6-millimetre embryo the cylindrical epithelium of the anlage in the tongue begins to grow rapidly in the form of a strand without a lumen.

In the 6.5-millimetre embryo the anlage is completely separated from the epithelium of the mouth and pharynx, and lies as a mass of cells in the connective tissue above the arch of the aorta. (See Fig. 7.)

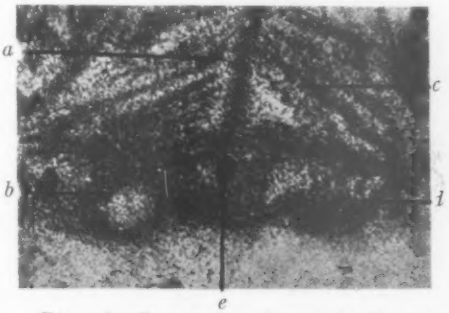

FIG. 26.—Cross-section through hyoid region in a 25-millimetre embryo. (Wenglowski.) *a*—Tongue septum. *bd*—Hyoid. *c*—Tongue muscles. *e*—Rest of thyro-glossal tract.

In the further development two processes take place. First, the anlage thickens at its lower end and is divided into two parts, one the right and one the left. On the other hand, a retrogression takes place and that portion of the anlage disappears which lies close to the epithelium of the tongue. This retrogression takes place slowly in that the strand disappears by breaking up into several portions which either entirely disappear or remain throughout life.

At the end of the second week and the beginning of the fifth week of embryonic life, this simple process is greatly complicated by the development of the hyoid bone. The hyoid bone develops from the second branchial arch, and in its growth it comes in contact with the rests of the mid-thyroid strand and divides the same into two entirely separate portions, that above it in the tongue, and that below it in front of the glottis. (Fig. 26.)

For simplicity's sake Wenglowski divided his examinations and explanations of the peculiarities of this development into three portions: The tongue, the hyoid, and the infra-hyoid regions.

The tongue portion.—The tongue develops in two entirely separate portions. The two lateral halves and tip develop from the first branchial arch and meet in the mid-line. Between these paired anlages is a small, long mass which His thought to be the single anlage of the tongue. The root of the tongue develops from the medial ends of the second and third branchial arches and the mass which lies between their medial ends is the so-called "furcula."

In the microscopical examinations of the tongue in the 6.5-millimetre embryo, one sees that the two central elevations of the first arch go to form the anlage of the tongue, and the two side elevations form the anlage of the lower jaw. The surface of the tongue is covered with squamous epithelium which has a tendency to flatten out.

In the nineteen-millimetre embryo, just behind the thyroglossal strand rests, some clear round cells appear. This is the anlage of the body of the hyoid. As the body of the hyoid grows rapidly anterior it is the first to come in contact with the thyroglossal strand. If this strand has not completely disappeared by that time then in a great many cases it becomes deeply incorporated within the periosteum of the hyoid. As the hyoid grows farther it grows downward and forward and presses into the thyroglossal strand and divides it into two portions, which either disappear or remain for life.

In the two-months embryo the foramen cæcum appears as a depression covered with squamous cells in some cases. In others it enters a canal without branches, usually lined with squamous epithelium but also at times with ciliated epithelium. The canal goes in a vertical direction and is the lingual duct. (Fig. 27.)

Towards the end of the second month the papillæ of the tongue, covered with

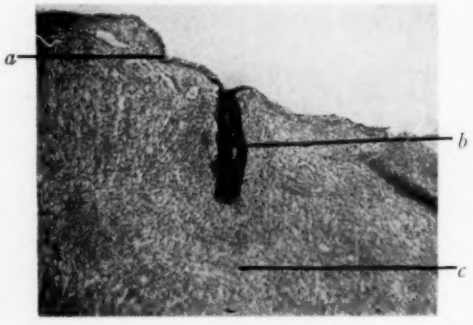

FIG. 27A.

FIG. 27B.

FIG. 27A.—Longitudinal section through foramen cæcum in embryo beginning of second month. (Wenglowski.) *a*—Epithelium of tongue. *b*—Lingual duct with lumen. *c*—Tongue tissue.
FIG. 27B.—Longitudinal section through foramen cæcum in embryo at end of second month. (Wenglowski.) *a*—Foramen cæcum. *b*—Lingual duct beginning to branch. *c*—Tongue tissue.

squamous epithelium, already appear. In those cases in which the lingual duct is present, the latter appears branched with short branches. No mucous glands are to be seen. (See Fig. 27.)

In the third month the papillæ of the tongue are very much larger and the lingual duct, if present, has much larger branches. These branches are lined with squamous or ciliated epithelium. The direction is vertical, but more toward the tip of the tongue than backward toward the tip of the hyoid.

In the fourth month the lingual duct is larger, more branched, and lined with the same epithelium as before.

In the fifth month the lingual duct is deep and branched and surrounded in its entirety with mucous glands which pass almost to the hyoid bone. Thus it is seen that the mid-thyroid anlage has a close relation to the base of the tongue structures. The strand with which the mid-thyroid lobe connects with the tongue surface, the thyroglossal strand, either totally disappears or rests of it are to be found within the tongue substance.

In the tongue root where the anlage of the mid-thyroid lobe is pinched off, a duct remains behind. This is the lingual duct. Out of thirty embryos examined Wenglowski

found it was present only eighteen times. It is lined with squamous and ciliated epithelium. (Fig. 28.)

At the beginning of the fourth month some of the epithelium of the floor of the mouth and the lateral outgrowths of the lingual duct can be torn away by the thyroglossal strand and be imbedded in the tongue substance, and here may form little cysts. Out of thirty embryos examined by Wenglowski six showed these cysts. The thyroid anlage can also leave behind it thyroid rests within the tongue. These were found in four out of the thirty embryos examined.

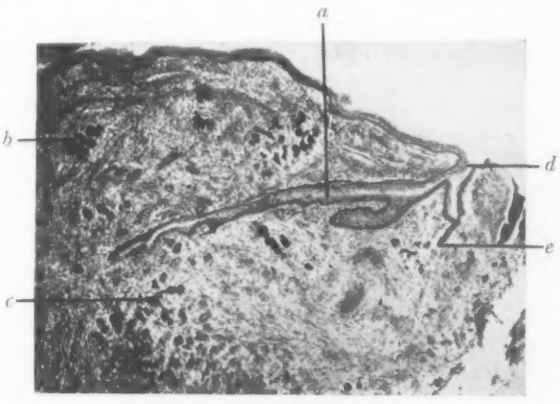

FIG. 28.—Longitudinal section through foramen cæcum in five months' embryo. (Wenglowski.) *a*—Lingual duct. *bc*—Mucous glands. *d*—Foramen cæcum. *e*—Branch of lingual duct.

In 117 autopsies performed by Wenglowski, the lingual duct was found in seventy-nine instances. In twenty-two it was long and not branched, and ran forward parallel to the surface of the tongue. In the others it was short, wide, and branched. Close to the tongue its lining is mostly squamous epithelium, and in the branches frequently ciliated epithelium. The farther away from the canal the more frequently ciliated epithelium is found in the branches. However, sometimes squamous cells are found here, too. The cysts found in the root of the tongue at autopsy differ somewhat from those found in the embryos in their structure and content. The cysts at times have outgrowths passing forward into the tongue. Lymphoid tissue may be found in the walls, and connective tissue walls, and the lining is mixed squamous and ciliated epithelium. Mucous cysts and thyroid rests may also be found in the tongue root. They were found twenty-six times in 117 autopsies, and fourteen times thyroid rests and mucous cysts were found combined in one case. (Fig. 29.)

FIG. 29.—Longitudinal section through foramen cæcum in cadaver of child. (Wenglowski.) *a*—Mucous glands. *b*—Branches of lingual duct. *c*—Lingual duct. *d*—Tongue muscles.

The hyoid portion.—H. Kadyi was the first to make more thorough examinations. Following this Zuckerkandl and Streckeisen published treatises on this subject. Wenglowski found evidences of the hyoid in the fourth week of embryonic life in the region of the second branchial arch. Due to the close proximity of the thyroglossal strand to the hyoid, the strand undergoes complicated changes as the hyoid grows. The study of the growth of the hyoid explains these complicated changes.

At the end of the first and the beginning of the second month of embryonic life, the thyroglossal tract has a fairly straight direction. The hyoid begins behind it but has no influence upon its direction, although it has a close relation to it.

The hyoid grows downward and forward and upward and backward rapidly. It

presses against the tract and bends it. The tract is not very elastic, and where it comes into contact with the hyoid the thyroid substance first disappears and is replaced by connective tissue which is most elastic. Thus the thyroglossal tract is divided into two portions by the connective tissue band. The upper portion is on the upper surface of the hyoid, and the lower portion goes downward from the lower border of the hyoid. The connective tissue strand lies within the periosteum of the hyoid and firmly fixates the tract to the hyoid. At the beginning of the third month the shape of the body of the hyoid changes. It curves so that the upper surface takes on a convexity and the posterior surface a concavity. A horizontal ridge develops on the upper anterior surface of the convexity of the hyoid, which divides the surface into an upper and a lower portion. That portion of the thyroglossal tract at the lower border is actually pushed backward

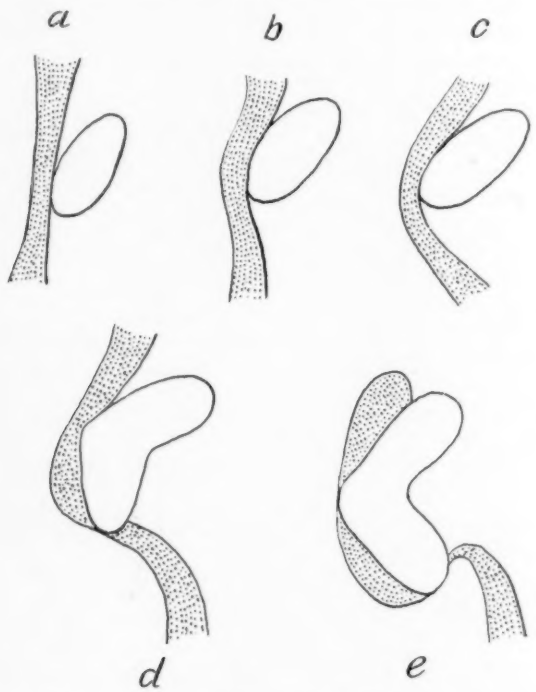

FIG. 30.—Diagrammatic sketch of relationship between thyro-glossal tract and growth of hyoid bone. Stages of development of hyoid and consequent division of tract. (See text.) (Wenglowski.)

and upward so that it comes to lie on the posterior surface. The ridge on the upper surface pushes into the tract and tends to make it obliterate at this point. The hyoid now bends at right angles at the ridge and this divides the tract into three portions: The first on the upper anterior surface of the body, the second on the lower anterior portion, and the third on the posterior surface of the hyoid. At the ridge and the lower body the tract is not to be seen in older embryos or at autopsy. Here the greatest pressure is exerted against the tract and it almost always disappears. (Fig. 30.)

The most frequently persisting portion is on the posterior lower surface of the hyoid. Here it is pushed aside without any pressure against it. The next most frequent are on the upper anterior surface, and the least frequent on the lower anterior surface of the hyoid.

In Fig. 31, taken from an embryo of six months, thyroid tissue is shown on the upper anterior surface of the hyoid. It also shows the lingual duct with its branches

separate from the thyroid tissue and the remainder of the thyroglossal tract. Thyroid tissue was found by Wenglowski mostly on the upper anterior surface of the hyoid, and if this persisted through the third embryonic month, then it would persist through life. Cysts also occur, but were found only after the eighth month and may lie under the periosteum.

Occasionally the pyramidal lobe is totally absent, and occasionally accessory thyroid tissue is found in its place from the hyoid bone down to the space in front of the thyroid cartilage. No microscopical connection can be found between the pyramidal lobe and the accessory thyroid tissue. The size of the accessory thyroid tissue varies very much. If the accessory thyroid tissue is on the hyoid bone it lies either directly on it, or within the periosteum. This is the case on the upper anterior surface. If it is on the lower anterior surface it never lies within the periosteum but only touches it and is surrounded by muscle bundles or fascia.

Microscopically, the accessory thyroid tissue is quite different from the thyroid. It never has a lumen and is lined with cuboidal epithelium. It is so enclosed and bound in by fascia and muscle fibres that it has no chance to expand. This may partially explain its difference in construction from thyroid tissue. It contains no colloid. If the thyroid lies in front of the hyoid it is subdivided into several portions by muscle fibres and fascia which attach to the hyoid bone. At one end it distinctly is in contact with the periosteum of the hyoid. At the other end it distinctly lies in the muscle planes. (Fig. 32.)

The accessory thyroid gland within the hyoid is always accompanied by hyoid cysts. It is never found in children but in adults. These glands are surrounded by dense fibrous tissue. Within the hyoid bone they are never completely surrounded by bone but have grown into the bone marrow from within the periosteum, this actually being the direction of least resistance. The thyroid gland structure is frequently within the wall of a cyst.

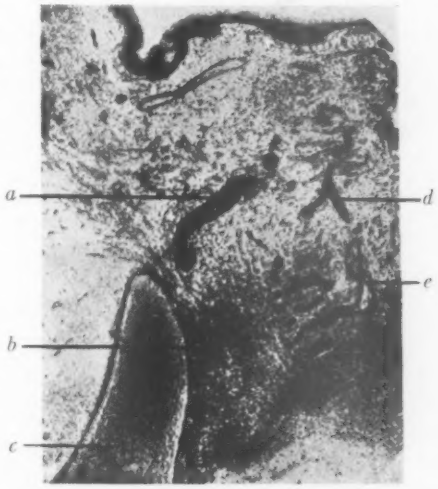

FIG. 31.—Longitudinal section of tongue in six months' embryo. (Wenglowski.) *a*—Rest of thyro-glossal tract. *b*—Mucous gland lobules. *c*—Body of hyoid. *de*—Lingual duct. This section shows concomitant presence of thyro-glossal tract and lingual duct.

Hyoid cysts can begin only in the eighth to ninth months of embryonic life. In 117 autopsies Wenglowski found them thirty-five times, thirteen simple cysts and twenty-two with thyroid tissue; in twenty-five adults, eight times simple cysts and six times with thyroid tissue; in ninety-five infants, twenty-seven simple cysts and twelve with thyroid tissue. The walls of the cyst are not always thyroid tissue. They may be mucoid glands mistaken for thyroid tissue. Usually they are not single, but there are two or three cysts. In adults they are one to one and one-half centimetres in size.

They are present on the anterior upper and anterior lower surface or within the bone. Contrary to the thyroid, the cysts are frequent at the anterior ridge of the hyoid. The hyoid atrophies as the pressure within the cyst is greater than that of the bone.

Cysts of thyroid gland tissue may be in front of the hyoid, separated from it by dense tissue. Bundles of muscle fibres may be seen between the thyroid tissue and the cyst.

Wenglowski found a cyst between the periosteum and the cartilaginous hyoid in an autopsy of an infant which in later growth would erode into the narrow cavity of the hyoid. If accessory thyroid tissue is present this can be found on any surface of the cyst wall. (Fig. 33.)

Microscopically, these cysts have a dense fibrous layer, sometimes with mucous glands in it. The mucous glands sometimes have a duct that enters the cavity of the cyst and the glands are filled with mucoid content. These mucous glands must be distinctly separated from the thyroid glands that are not within the cyst wall but lie close to it, separated by muscle fibres or con-

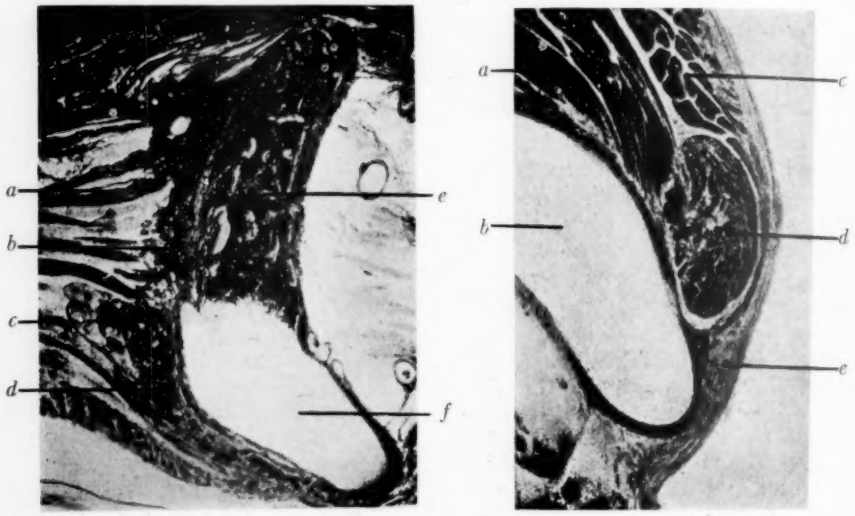

FIG. 32.—Left—Longitudinal section through body of hyoid. (Wenglowski.) *a*—Tongue muscles. *bcd*—Rests of thyroid gland tissue. *ef*—Body of hyoid.
Right—Longitudinal section through body of hyoid. (Wenglowski.) *ac*—Neck muscles. *b*—Body of hyoid. *d*—Thyroid gland tissue. *e*—Tendons.

nective tissue. Lymphoid tissue may also but very seldom be present in these cysts.

Sometimes the shape of these cysts is altered by outgrowths which frequently go upward into the tongue tissue. These outgrowths may be branched and multiple, and some may be quite long and have a clubbed ending with mucous glands in the end of the canal. The lining of the cyst may be subdivided into: first, cysts with ciliated epithelium; second, cysts with squamous epithelium; third, cysts with ciliated and flat epithelium; fourth, cysts with multilocular and flat epithelium; fifth, cysts without epithelium.

One point is certain, namely, that in the majority of cases the epithelial lining is a mixed one. The stratified squamous and ciliated epithelium is usually composed of only a few layers. Its variation and location are indefinite. The content is usually fairly thick, opaque and glarey. Cavernous

cysts may be found in front of the hyoid and also in the pyramidal lobe of the thyroid. (Fig. 34.)

To summarize.—As the anlage of the middle thyroid lobe grows into the depth, not only does it alone grow into the depth, but it takes along with it the covering of the mouth cavity, namely, ciliated and squamous epithelium and all the adherent peculiarities of this epithelium, such as mucous glands, lymphoid follicles and other structures.

When any of these structures have come to their resting place, they get there long before the muscles and fascia grow and attach to the hyoid bone, and if the muscles and fascia meet them as they grow toward the hyoid they either envelop them or grow through them, thereby dividing them. Further, a combat takes place in which, on the one hand, these embryonal

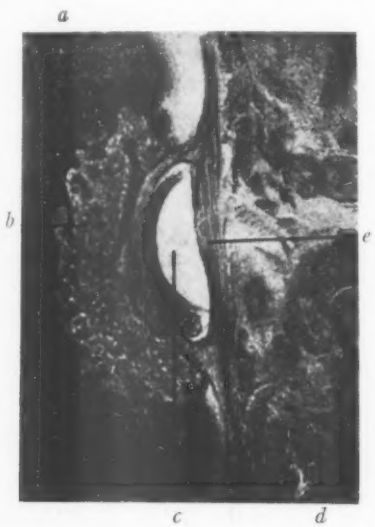

FIG. 33.

FIG. 34.

FIG. 33.—Longitudinal section through hyoid showing a cyst within the body of the hyoid bone beneath the periosteum in a cadaver of a young child. (Wenglowski.) *a*—Body of hyoid. *b*—Thyroid gland tissue attached to cyst. *c*—Cyst within the bony tissue. *d*—Thyroid gland tissue. *e*—Periosteum.

FIG. 34.—Longitudinal section through the hyoid. (Wenglowski.) *ac*—Hyoid. *b*—Thyroid gland lobule. *d*—Multilocular cyst.

structures tend to grow, and on the other hand they are compressed by the surrounding structures and thereby hindered in their growth. Thyroid tissue is easily obliterated and hindered in its growth as it is tender and needs great freedom in order to enlarge and become colloid in character. The greatest freedom is at the upper anterior surface of the hyoid. The epithelial structures, however, have more power in their growth than the thyroid structures, and the epithelial cysts grow through the muscles and even erode the hyoid bone. The squamous epithelium and ciliated epithelium and mucous glands come from the neighboring mucous membrane of the tongue and are drawn down into the tongue substance by the thyroid anlage, and maintain their own original characteristics. The lingual duct is a shallow canal lined with squamous and ciliated epithelium in early embryonic life. Later it

becomes more complicated and more branched, and its terminal branches are surrounded by mucous glands. Developing entirely separately from the thyroglossal tract it may co-exist at the same time, independently, as shown in Fig. 31.

The multilocular cysts must be looked upon as distended mucous glands, which have lost their outlet duct, and by distension have lost the mucous epithelium by pressure atrophy.

The infrahyoid region.—This region is practically the same embryonically as in later life. In 107 autopsies Wenglowski found one instance in which there was only a right lobe of the thyroid, with a total absence of any signs of a middle lobe or left lobe. One case had the left lobe missing but the middle lobe was present, and in six cases the isthmus of the thyroid was missing. The pyramidal lobe was present *in toto* or in part in seventy-nine cases, that is, 67 per cent. It was complete forty-eight times, and in thirteen instances it did not reach the hyoid but stopped at the upper level of the thyroid cartilage. If it reached the hyoid it always passed to the posterior surface of the bone. Many other variations of the pyramidal lobe were found by Wenglowski. The pyramidal lobe arises from either the right or the left portion of the isthmus, usually not from the middle portion, and passes in a pyramidal and conical form upward with the base at the isthmus. The tip of the pyramidal lobe is attached to the posterior periosteum of the hyoid with a fascial band, the lobe itself lying free. In one-third of the cases, striated muscle fibres were found scattered through the pyramidal lobe.

Microscopically, the pyramidal lobe depends upon the amount of pressure to which it is subjected or whether it is traversed by muscle fibres. Depending upon the pressure different stages of atrophy are noted. The cysts in the pyramidal lobe are mostly lined with ciliated epithelium, although, more rarely, squamous and cavernous multilocular cysts are found. These occur usually in the upper tip of the pyramidal lobe, close to the hyoid, and are mostly lined with a single layer of ciliated epithelium and are round, simple, and without prolongations. The contents are transparent and mucoid. The mixed epithelial cysts are rare and do not contain mucous glands. Multilocular cysts in the uppermost portions are more frequent than the mixed epithelial cysts.

Cysts in the lower portion of the pyramidal lobe also occur. They may be alone or combined with upper pyramidal cysts, and are lined with ciliated epithelium. The structures drawn in from the mucous membrane of the mouth by the mid-thyroid anlage are most frequently seen in the tongue portion, less frequently in the hyoid portion, and still less frequently in the infrahyoid or pyramidal region. The middle lobe thyroid anlage very easily divides into two portions which reunite close to the isthmus, so that two pyramidal lobes are present. From the fourth to sixth weeks of embryonic life these pyramidal lobes usually retrogress and disappear, although some vestige of them is to be found close to the isthmus. One or the other may persist. Usually the left one persists.

The region in the adult where this division of the mid-thyroid anlage takes place is in the lower half of the hyoid body. Cases have been observed where this division has taken place lower down. They unite at the lower border of the hyoid and at the isthmus of the thyroid.

Clinical Observations.—Two types of mid-line cysts are found pathologically in life: (*a*) Epithelial tubes or cysts with simple or complicated structure of the walls; and (*b*) thyroid tissue rests. The first group creates the mid-line fistulæ or cysts; the latter causes a goitre at abnormal locations. No canal or complete fistula can exist. In spite of this many authors still accept the theory that the mid-line fistulæ are rests of the thyroglossal duct which should be called, by rights, the thyroglossal tract. It was usually believed that the reason the tract was not complete was that the hyoid grew into the

duct and obliterated it. Most of the mid-line fistulæ end at the hyoid, and this was thus erroneously explained.

In 1892, Marchand dissected a duct up to the hyoid bone, separated it from the periosteum to which it was tightly adherent and then dissected out a thickened strand to the foramen cæcum. He thought the duct had been obliterated but had previously been present. In the thickened strand passing through the tongue Wenglowski never found evidence of the thyroglossal duct. There are some cases in which the mid-line fistulæ do not touch the hyoid and pass upward above the hyoid, there to end blindly, never to go all the way to the foramen cæcum. These fistulæ are formed from the so-called Bogdalek canal.

The accepted theory was that the cysts or fistulæ of a thyroglossal tract would have to be lined with ciliated epithelium, but one finds squamous epithelium in many cases. The squamous epithelium found was explained by the squamous epithelium growing into the tract from the tongue and into the duct from the skin at the fistula opening. Microscopical examinations proved this theory to be erroneous. In the simple cysts alone one finds squamous or ciliated or mixed epithelium. This, of course, cannot come from the neighboring tongue structures nor from the tissues around the fistulous opening. Squamous cells found in a section are always the rests of a cyst or one of its processes that always contain well-preserved epithelium.

Only in the two- to three-millimetre embryos is the thyroid anlage covered with epithelium. After this, as it grows downward, the epithelium disappears.

How, then, do the cysts and fistulæ develop?

Along the entire mid-thyroid anlage there are groups of different types of epithelium which occur in well-developed embryos and cadavers as cysts. *This epithelium does not arise from a thyroglossal duct*, as the latter duct does not exist, but it arises from the mouth cavity epithelium which is mechanically torn into the tissues by the thyroid anlage in its rapid growth and remains in different degrees of distension.

In very young embryos the mouth cavity is lined with squamous epithelium and with ciliated epithelium admixed. The ciliated epithelium is most frequently found in the region of the furcula, the base of the tongue, where the thyroid anlage arises. This explains why the epithelium pulled into the depth may be of different types; and that it is pulled in is shown by the finding that the farther one gets away from the tongue surface the more infrequent are the epithelial rests found, until they totally disappear. The epithelium maintains its inherent characteristics and later becomes surrounded with connective tissue and forms a cyst. In the cysts, as in the mouth cavity, acinous mucous glands develop and lymphoid tissue, *etc.* This process has no correlation with the development of the thyroid anlage.

As these cysts often contain lymphoid structure in the wall and due to other causes they can become infected and inflamed, they then grow rapidly to quite a size and open externally and spontaneously. A fistula develops due to the epithelial lining which causes a persistent fistula with secretion, incurable by itself.

The age at which these cysts and fistulæ develop is uncertain. From fifteen to thirty years is the most frequent age. They are never present at birth.

The fistula develops by the suppuration of the cyst, adhesion to the skin and perforation. This may occur from the lower jaw to the sternum in the mid-line, dependent on where the skin becomes adherent. The cyst is almost always in close connection with the hyoid, except those which lie above the hyoid and within the root of the tongue which may cause the formation of a fistula.

The lumen of the fistula ends with the hyoid or a depression in it. It never passes through the bone. In the strand above the hyoid running to the foramen cæcum an epithelial-lined lumen is never found.

Microscopically, the mid-line fistulæ are branched and one finds one larger lumen surrounded by several smaller ones. The difference between the lateral and mid-line fistulæ is that in the mid-line a great number of fistulæ can be found similar almost to

the structure of an adenoma. The explanation is that the original cyst which existed previous to the development of the fistula was distended by its content and had several processes passing into the surrounding tissues. The smooth lining of the cyst after the collapse became corrugated and snake-like and branched, and gives the picture of several lumina. Not only the main lumina but several of the pockets are cut across at various levels. (Fig. 35.)

The lumen of the fistulæ and cysts is mostly cylindrical, covered with little cilia, but admixture of squamous and ciliated epithelium may be found. Rarely are purely squamous-cell linings found. The ciliated epithelial-lined cysts have two to three layers of cells. Within the wall there is round-cell infiltration. The cysts can occur below the hyoid, above it, and within the tongue substance, and may grow externally and internally into the mouth cavity. The small cysts situated near and around the hyoid may develop into pathological mid-line cysts and fistulæ of the neck. They maintain their histology. The close adhesion to the hyoid is a characteristic of the "normal

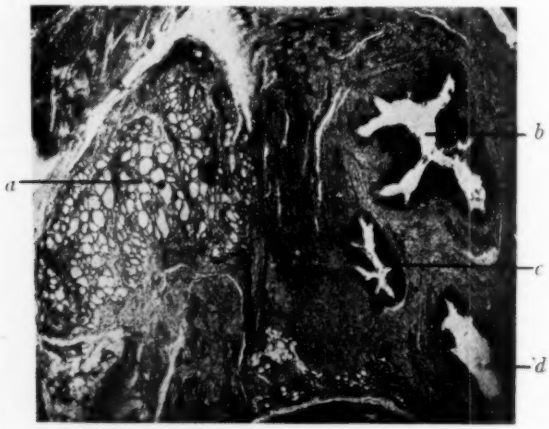

FIG. 35.—Cross-section through a median fistula showing microphotograph of several lumina of fistula. This is caused by the collapse of the cyst, which had several processes, upon the rupture of the cyst and consequent development of a fistula. This collapse gives the inside lining of the cyst a corrugated appearance which on cross-section therefore shows several lumina. *a*—Thyroid gland lobule. *bd*—Lumina of fistula. *c*—Ciliated epithelium of fistula.

cysts" in this region. The cysts have no relation to the thyroglossal duct, as this is only a hypothetical duct and in actuality does not exist.

The fistulæ may arise from either pyramidal lobe, and the number of fistulæ may depend on how many of the "normal cysts" may be present and develop into pathological cysts. Recurrences of fistulæ may be due not to an incomplete operation but may be a cropping up of a further "normal cyst" that had previously not been enlarged, but which secondarily and later had become inflamed and then enlarged and broken through the old scar, the place of least resistance.

Treatment.—Complete operation for the cure of this condition means the complete removal of all epithelial tissue in connection with the fistulæ. The mid-portion of the hyoid bone should be removed. In the strand that goes from the hyoid to the foramen cæcum epithelial rests and thyroid-gland tissue may be present, and therefore, in order to effect a complete cure, it is wise to remove this also.

In the October, 1921, issue of the Surgical Clinics of North America

Dr. Walter E. Sistrunk, of the Mayo Clinic, published some very illuminating pictures which showed the principles of this radical operation which would be most apt to effect a cure. Dr. Edwin Beer at that time suggested a similar procedure. Older surgeons also followed similar plans. The operation is performed through a transverse incision across the neck at the level of the hyoid bone. The skin and platysma muscles are reflected. The cyst is usually found lying between the raphé connecting the sternohyoid muscles.

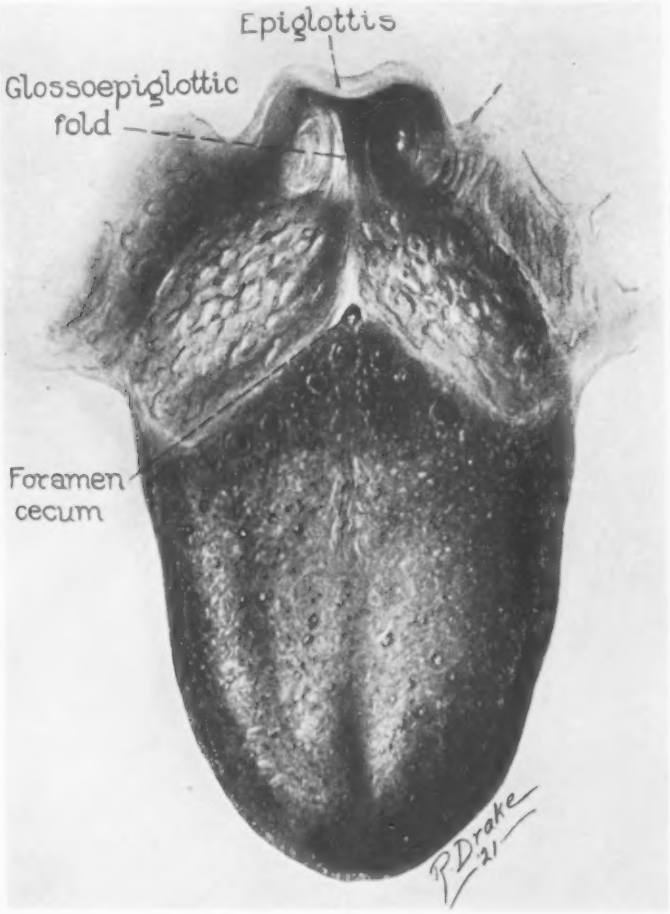

FIG. 36.—Diagrammatic drawing of upper surface of tongue showing foramen cæcum and circumvallate papillæ. (Sistrunk.)

It is dissected free up to the hyoid bone. At this point the tract is firmly attached to the hyoid. The muscles are separated from the centre of the hyoid bone, and about a little less than half a centimetre of the bone is removed. Then, without any attempt to isolate the strand running to the foramen cæcum, the tissues are cored out from this point directly to the foramen cæcum, taking along the strand with the tissues surrounding it for a distance of about 0.3 centimetres on either side. In doing this it is

necessary to keep clearly in mind the direction of the foramen cæcum. This corresponds to a line drawn at an angle of 45° backward and upward through the right-angle intersection of lines drawn horizontal and perpendicular to the superior central portion of the hyoid bone. In the dissection of the strand, a portion of the hyoid bone, a portion of the raphé joining the mylohyoid muscles, a portion of each of the geniohyoglossus muscles, and the

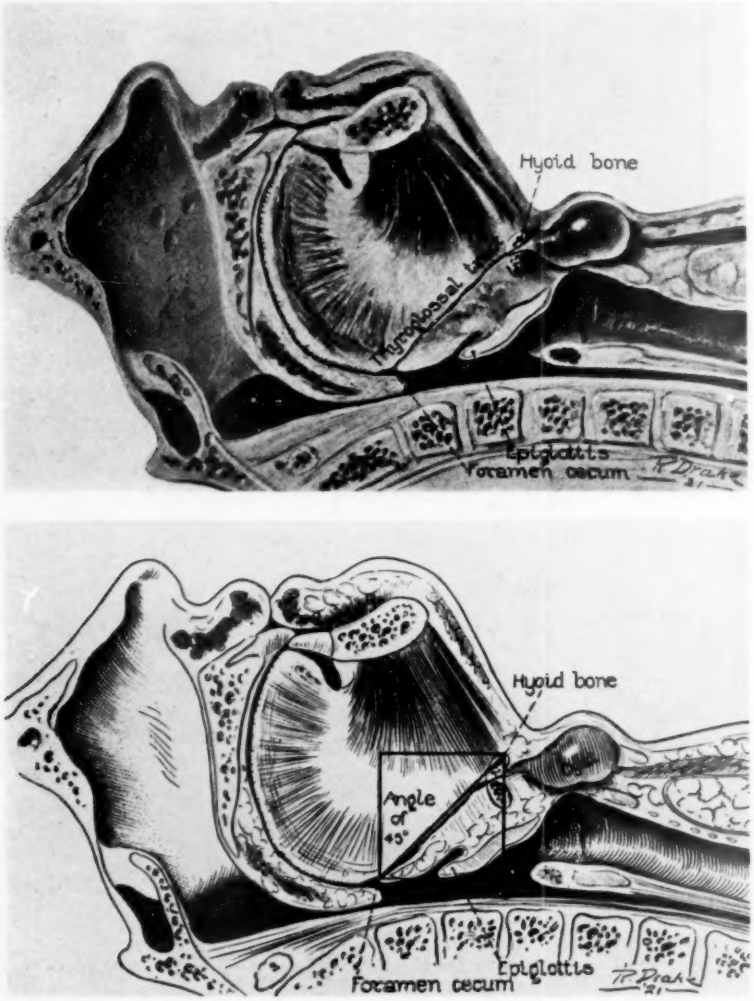

FIG. 37.—Diagrammatic drawing showing relation of cyst and course of the thyroglossal tract to hyoid and tongue structures. Lower drawing shows principle underlying technic of total removal of the tract. (See text.) (Sistrunk.)

foramen cæcum are removed. The opening in the mouth is closed and the geniohyoglossus muscles are drawn together with interrupted catgut sutures. If desired the dissection may be stopped just before reaching the foramen cæcum, thus not opening into the pharynx. The tissues surrounding the cut ends of the hyoid bone are either brought together with chromic catgut

sutures in such a manner as to approximate the edges of the bone, or they may even be left separated. A small rubber tube, and preferably, also, a small tampon are introduced down to this point, and the skin is closed. (Figs. 36, 37.)

CASE REPORTS.—In giving these case reports I shall give only a very short abstract of nine of these cases as they were all operated upon identically, and I shall describe only one case in detail in order to avoid repetition.

CASE I.—M. K., seven-year-old boy, admitted to the service of Dr. George H. Semken, at the N. Y. Skin and Cancer Hospital, with a recurrent thyroglossal fistula just below the hyoid bone. Operated on December 16, 1921, with the total excision of the fistula, portion of the hyoid bone and coring out of the tract from the hyoid to the foramen cæcum. Uneventful recovery with cure of condition.

CASE II.—D. H., fifteen-year-old girl, admitted to Doctor Semken's service at the Skin and Cancer Hospital and operated on December 20, 1922. She had had three previous local operations with three recurrences. Radical operation was performed with excision of the entire tract from skin fistula to foramen cæcum and patient seen eight years later was entirely well.

CASE III.—J. C., fifty-three-year-old man, who noticed swelling six months previously. This was incised and developed into a fistula. Was admitted to the service of Dr. Willy Meyer, at the Lenox Hill Hospital, and operated on in May, 1922, under colonic anæsthesia. The operation was performed as usual and was uneventful. Two hours after the operation the patient died and autopsy did not reveal any cause of death, but it was attributed to the probable falling back of the patient's tongue while still under the effects of the colonic anæsthesia and death by suffocation. The operative field was negative.

CASE IV.—T. M., twenty-three-year-old man, admitted to the service of Doctor Semken, at the N. Y. Skin and Cancer Hospital, with a recurrent thyroglossal fistula. Operated under colonic anæsthesia on October 30, 1923, with total excision of the tract with a portion of the hyoid bone. Uneventful recovery and cure.

CASE V.—K. McQ., twenty-two-year-old girl, admitted to the service of Dr. Carl Eggers, at the Lenox Hill Hospital, with a recurrent thyroglossal fistula that had been operated on elsewhere one and one-half years before. Radical operation with excision of a portion of the hyoid bone in May, 1924, under colonic anæsthesia. Uneventful recovery and healing. Five months later a small cyst developed at the angle of the scar. This was curretted and patient has remained well to date. This is probably one of those cases where a new cyst developed from epithelial rests that enlarged subsequent to the first radical operation.

CASE VI.—S. S., four-year-old boy, admitted to the service of Doctor Semken, at the N. Y. Skin and Cancer Hospital. Operated on October 7, 1924, under general anæsthesia. Uneventful recovery and entirely well when seen two years later.

CASE VII.—T. G., eight-year-old boy, admitted to Doctor Semken's service at the N. Y. Skin and Cancer Hospital. Operated on December 10, 1927, after previous operation elsewhere. Typical operation with uneventful recovery.

CASE VIII.—W. R., seven-year-old boy, referred to me by Dr. John D. Kernan and operated on in November, 1928, at the Lenox Hill Hospital on Doctor Kernan's service This boy had also had a previous operation with a subsequent recurrence of a cyst just above the previous scar. Typical complete operation from skin to foramen cæcum with removal of a portion of the hyoid bone. Uneventful recovery and cure. (Fig. 38.)

CASE IX.—M. G., ten-year-old boy, admitted to the service of Doctor Semken, at the N. Y. Skin and Cancer Hospital, with a recurrent thyroglossal fistula. Radical operation under general anæsthesia on October 26, 1928. Uneventful recovery and well to date.

CASE X.—Mrs. A. V. R., a lady thirty-nine years of age, referred by the late Dr. McKelvey Bell, suffering from a recurrent thyroglossal fistula. Eight years previous following a severe attack of grippe a swelling rapidly developed in the mid-line of the neck just below the level of the hyoid bone. Was operated upon by the late Dr. Charles N. Dowd, of the Roosevelt Hospital, in 1917. Wound did not close. Later treated in Washington, D. C., with carbolization and the wound closed and remained closed for two years. In December, 1919, had pain in throat again and swelling developed. Was operated on at that time under local anæsthesia. Closed but recurred in September, 1925. In November, 1925, was again operated upon by Doctor Dowd, who this time is said to have gone through to the mouth. From that time on the wound remained open. The patient was entirely well except for a fistula in the mid-line just below the level of the hyoid bone.

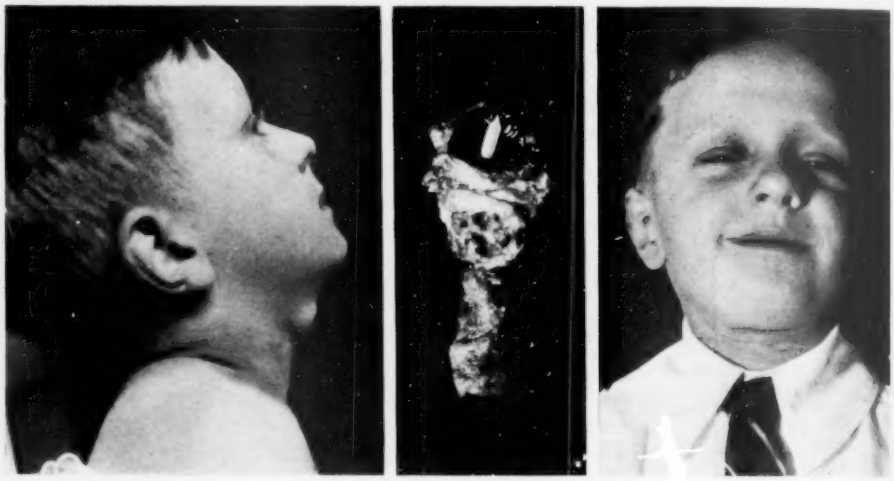

FIG. 38.—Author's Case VIII. Showing patient with recurrent cyst before and after operation. Also typical specimen removed, the cyst, section of hyoid and tissue cored out through tongue representing strand running to foramen cæcum.

There was a pin-point opening from which a very slight, non-odorus discharge appeared. Probe did not enter it. Bismuth injection showed a branched tract passing above the hyoid bone. Just before operation Doctor Bell was kind enough to inject the fistula with a solution of methylene blue.

Operation at the Lenox Hill Hospital on November 4, 1926, under colonic ether-oil anæsthesia. An ellipse of skin was excised over the region of the hyoid bone surrounding the previous operative scar and fistulous opening. Skin was then reflected exposing the platysma muscle. This was then incised, bringing the incision down to the deeper structures. The operation was then continued according to landmarks. All of the old scar tissue and fascia was dissected upward from over the thyroid cartilage to the hyoid bone above. Similarly, the scar tissue from previous operations was dissected downward from the sub-mental space to the hyoid bone, exposing the mylohyoid muscle as the floor of the field. Laterally, the tissues were dissected medially on either side beginning at the border of the sub-maxillary salivary gland and sweeping across the hyoid bone and leaving all of the tissue attached to the hyoid bone. A portion of the centre of the hyoid bone a bit over one-quarter inch in length was then excised and the thickened tissue strand was then cored out in a direction through the tongue muscles corresponding to a line drawn at 45° through a right angle formed by a line horizontally passing upward

at the anterior border of the hyoid bone and a line dropped vertically to the spinal column from the lower border of the hyoid bone. This dissection was carried down through the mylohyoid muscle and the genio-hyoglossus muscle to the mucous membrane at the foramen cæcum, which was also removed. Here, in this region, for the first time,

FIG. 39.—Author's Case X. Showing patient with fistulous opening in centre of previous operative scar and patient following operation with total removal. Also (left) specimen, anterior view and (right) posterior view of specimen showing cyst, section of hyoid and strand running to foramen cæcum which is also visible. (See text.)

some of the methylene blue injected before operation was seen. The tongue wound was then thoroughly cauterized with the Paquelin cautery and disinfected with 5 per cent. iodoform in ether. The tongue was reconstructed by suturing the hyoglossus muscle with

No. 00 chromic sutures. Two split drains and a small iodoform tampon were placed into the space between the hyoid bone. On account of the previous operations the hyoid ends in this instance were not approximated. The platysma was separately sutured with No. 00 chromic catgut interrupted sutures. The skin was closed with interrupted black silk. The convalescence was uneventful except for the fact that each of the chromic catgut knots placed in the platysma was discharged through the skin wound, probably explained by the poor circulation and absorptive power on account of the three previous operations. In another instance I would use plain catgut instead of chromic catgut. Otherwise, the wound healed, and there has been no further trouble to date, which is five years post-operative. (Fig. 39.)

CONCLUSIONS

(1) The mid-thyroid anlage develops from the epithelium of the floor of the mouth as a thick-celled strand without lumen.

(2) The anlage in its rapid growth drags surrounding cells into the depth of the mesenchyme.

(3) The inherent embryonal characteristics continue in these epithelial rests as they do in the mouth, and they can grow and develop, but being surrounded with the surrounding tissues they can change into different types of cysts.

(4) The thyroid anlage divides into two halves; the unpaired part of the thyroglossal tract retrogresses and either totally or partially disappears.

(5) The hyoid bone develops in the fourth to fifth week. The body of the hyoid comes in close contact with the already well-developed thyroglossal tract.

(6) The body of the hyoid presses into the tract, injures it, subdivides it at certain points and changes its direction.

(7) The retained rests of the mid-thyroid anlage are epithelial structures from the floor of the mouth and are spread out between the foramen cæcum and the mid-thyroid anlage.

(8) They are most frequent in the root of the tongue and the hyoid, and rarer the nearer one comes to the mid-thyroid anlage.

(9) The thyroid particles usually remain as atrophic parts of the gland. The epithelial rests change into cysts which are lined with ciliated, squamous and mixed epithelium.

(10) In pathological conditions thyroid particles can develop into goitres. The "normal cysts" can develop into pathological medial cysts and fistulæ.

(11) A duct does not occur, only a tract, and it plays no part in the formation of cysts or fistulæ. These come from the mouth epithelium dragged in, which may form a "normal cyst." An incomplete fistula can occur, but not a complete one.

(12) The foramen cæcum is a remainder of the spot where the anlage developed. The lingual duct is not a part of the thyroglossal tract, but develops from the mouth epithelium which has been dragged in. It develops at a later time. Therefore, its form and direction are not always the same. In young embryos it has no processes, but may have many in older embryos. The tract and lingual duct may occur together.

(13) The tongue cysts develop from the pinched-off processes of the lingual duct.

(14) The radical cure of these conditions necessitates the complete removal of the cyst, the hyoid bone, and those tissues running from the hyoid bone to the foramen cæcum.

PART III

There are still a few pathological conditions that have to be mentioned in order to complete the congenital conditions that may occur in the neck but which do not fall into the classifications of lateral or medial cysts or fistulæ of the neck. These are well described in Dr. Semken's article in Nelson's Loose Leaf Surgery from which the following facts are taken.

SUBLINGUAL AND SUBMAXILLARY CYSTS.—The mesobranchial field lies between the ventral ends of the branchial arches as they grow forward to unite ventrally. The anterior portion of the tongue and floor of the mouth is formed in this field from the anlage of the first branchial arch. This is from one process of the arch; from the other process the lower jaw is formed.

Many inclusions of epithelial cell groups may occur here and form cysts.

If they occur in the mid-line and in the suprahyoid region they are usually thyroglossal cysts, if lateral they are true branchiogenetic cysts, and if in the sublingual region they are epithelial rests in the mesobranchial field. These may grow into the sub-maxillary region but have no relation genetically with a ranula.

Rarely they cause mechanical disturbance and are easily removed surgically.

CYSTIC HYGROMA OF THE NECK.—*Embryology.*—In mammals the lymphatic system begins in the neck in the two jugular sacs on either side near the junction of the internal jugular and subclavian vein. Small veins, branches of the internal jugular, get rid of the blood, separate from the vein and coalesce to form sacs. Thus the lymphatic system is derived from the venous system. Later the lymphatic vessels join the vein again and empty into them. Finally they develop into the important primary groups of lymph-nodes. They take a prominent part in the development of the entire lymphatic system.

Two jugular and two subclavian sacs are joined in the human into one but this fact explains the extension of the later pathological lymphatic structures extending upward into the neck and downward under the clavicle.

The histology is that the hygromas have a fibrous wall with lymphatic follicles in it and lined with endothelial cells. The cystic hygromas apparently arise in these vestigial remnants of this tissue.

Clinical conditions.—The hygromas occur essentially in early childhood. At birth there is a soft swelling at the outer border of the sternomastoid muscle just above the clavicle with one-quarter below the clavicle. They are quiescent until they are stirred into rapid growth by an infection or

childhood disease. The hygromas are soft and elastic with few symptoms and push the vessels and nerves aside in their expansile growth.

Pathological anatomy.—Unilocular and multilocular cysts may occur. They have a thin, firm wall with smooth, endothelial lining. In inflammatory conditions granulation tissue may replace the lining. The contents are a thin serous fluid which may be admixed with blood and in infection this may be changed into pus.

Differential diagnosis.—This rests between lipoma, lateral cyst of the neck, lymphangioma and aberrant thyroid.

Treatment.—Operations are dangerous for this condition on account of the youth of the patients and the extension into regions difficult of access. Injections are of no value as the hygromas are usually multilocular. X-ray and radium is of great value. In cases suitable for surgery excision is the method of choice. The skin and platysma are cut with the outer layer of the middle cervical fascia. The landmarks are the vessels and nerves and the wall of the cyst. Total careful removal is essential. Post-operative irradiation is of value. If not totally removed recurrence is rapid. If the hygroma passes into the axilla complete division of the pectoralis major with later resuture is necessary.

LYMPHANGIOMATA OF THE NECK.—The lymphangiomata arise in the congenital defects in the development of the lymphatic vascular system. They are derived from the capillary vessel primordia while the cystic hygroma develop from the larger jugular sacs.

They may be simple, cavernous or cystic.

Pathological anatomy.—The simple angiomata are dilated vessels not sharply defined from the neighboring lymph-vessels, are circumscribed or diffuse occurring in the skin and subcutaneous tissue of the face and neck. They are partly effaced by pressure. Skin blebs may occur.

The cavernous type are large spaces with a single layer of endothelial lining. Between the spaces is cellular tissue in larger or smaller amount in which many lymphocytes and some lymph follicles may be found. They are larger in size, semi-fluctuating tumors, flabby, and smooth or firm, and slightly nodular. In the neck they occur in the skin or subcutaneous tissue and may have finger-like processes that grow into the depth and push structures aside, but do not invade them. They can be partly effaced by pressure.

The cystic lymphangiomata are collections of small cyst-like vesicles with some proliferative changes in the stroma found in the cavernous type. They contain clear fluid, occasionally turbid. The cystic type may be large tumors in the neck, axilla, chest, beneath the skin, usually beneath the fascia, more or less separated from the surrounding tissues with which they have no intimate connection by way of the lymphatic channels. An angiomatous condition may accompany them.

They represent the only benign tumors of the lymphatic system, occur in

childhood, and are slow-growing, present no symptoms and may be covered with blebs and have an inflammation ingrafted upon them.

Treatment.—The effect of irradiation is that of obliteration. For the cavernous and cystic type with fibrous proliferation surgery is indicated. Around and underneath the tumors an injection should be made with 1 : 30,000 adrenalin (epinephrin) solution to control bleeding. Suspicious areas must be carefully removed from the under surface of the skin flaps with scissors. The deep cavernous types must be carefully removed, dissecting by landmarks. Operation should be followed by irradiation.

HÆMAGIOMA OF THE NECK.—These occur cutaneous and subcutaneous and originate from small vessels and capillaries as the lymphangiomata do. Surgery with the previous injection of adrenalin and removal with ligation of the feeding vessels is the method of choice in treatment.

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COMPARATIVE STUDY OF ANTISEPTICS IN EXPERIMENTALLY PRODUCED LOCAL INFECTIONS

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A host of germicidal compounds have been introduced during the past few years for local treatment of infected wounds and ulcers and for application to the unbroken skin and mucous membranes as disinfectants.

Most of them are complex organic compounds and many depend upon mercury or combinations of this metal with dyes for their germicidal action.

Kolmer states that an acceptable compound should (*a*) kill all pathogenical organisms or greatly reduce their numbers; (*b*) act within a period of five minutes; (*c*) penetrate epithelial cells; (*d*) dry rapidly, but not too rapidly; (*e*) stain sufficiently to mark off the area; (*f*) be free of undue irritation, especially when used on mucous membranes; (*g*) be of low toxicity; and (*h*) not be precipitated by the proteins of the blood, exudation, pus, *etc.*

The object of this study was to determine what antiseptic could be recommended for use in the average hospital clinic and by the practicing physician in the treatment of local infections. Most local infections seen in surgical clinics are caused by the staphylococcus group and associated pus producing microörganisms, and for this reason we selected those germicides for which are claimed selective activity against these microörganisms. Also, we used those most popular among physicians and the laity, such as mercurochrome, mercurophen, metaphen, and tincture of iodine. It will be noted that the first three are mercurials.

As this paper is not a critical review but a statement of our results, it suffices to mention only a few of the more recent publications.

Since the introduction of mercurochrome by Young and his associates, who claim unusual antiseptic properties for the compound in almost every field of medicine, numerous articles have appeared, both favorable and unfavorable.

Walker and Sweeney,[1] in a comparative study of mercurochrome, gentian violet and acriflavin injected intraperitoneally and applied subcutaneously in staphylococcus and streptococcus infections in mice, report that each product has its field of usefulness.

Colebrook and Hare[2] report that the bactericidal properties of human serum treated with mercurochrome are less than those of the untreated serum for staphylococcus and streptococcus. Similar observations were also made on the bactericidal properties of rabbit sera for *Bacillus typhosus.*

Sanner and Hill,[3] Scott and associates,[4] Reddish and Drake,[5] all report favorable results with mercurochrome applied locally, intravenously and intraperitoneally in experimental infections.

On the other hand, Simmons[6] and also Rodriguez[7] concluded that mercurochrome

is not effective as an antiseptic on the unbroken skin and unbroken mucous membrane. Both of these workers found tincture of iodine more efficient.

Douglas and his co-workers[8] tested the effect of mercurochrome upon local infection in the leg of dogs by injection into the femoral artery. They observed no difference between the treated and untreated animals.

While the reports in the literature on mercurophen and metaphen are not so numerous as those on mercurochrome, the few articles available report these germicides as efficient, especially for local application, to which their use has been almost entirely confined. The recent work of Raiziss, Severac and Moetsch,[9] reporting metaphen 100 per cent. efficient as a skin germicide, has been questioned by White and Hill[10] as they were unable to confirm their results. However, Raiziss and his associates have since confirmed their original findings (unpublished report).

The plan of our experiments was to produce in guinea-pigs local abscesses with a recently isolated culture of staphylococcus aureus. The hair of the abdomen was removed, a small transverse incision made in the skin and a subcutaneous pocket produced. This pocket was packed with aleuronat moistened to the consistency of a paste with a twenty-four-hour culture of the staphylococcus.*

Within seventy-two hours all the guinea-pigs developed abscesses. They were then divided into several groups and treatment with the various germicides commenced. This consisted of removal of the scab which formed over the incision; liberation of pus by gentle pressure and application of the germicidal compound with a cotton applicator. This was repeated once daily. No attempt was made to protect the abscess in the interval of treatment. Daily observations of the gross appearance of the lesion was noted; degree of healing, the character and amount of pus, and in some instances the presence or absence of microörganisms.

The experiments were repeated three times, following the same procedure.

All compounds used were purchased in the market, except the tincture of iodine, which was prepared according to the officinal method.

The first experiment comprised five groups each of four guinea-pigs. After abscess production they were treated with mercurochrome, 2 per cent. aqueous solution; mercurophen, 2 per cent. aqueous solution; metaphen, 1:500 (as purchased), and tincture of iodine.

The second series was identical with the first except for an additional group treated with mercurophen, 1:500 dilution.

In the third series we substituted mercurophen, 1 per cent. solution, for the tincture of iodine, for reasons stated below.

RESULTS

We observed that all the abscesses in the 1 and 2 per cent. mercurophen treated animals were healed in a maximum time of eleven days. The metaphen, 1:500 solution, and the tincture of iodine, treated animals required fifteen days for complete healing. One animal treated with tincture of iodine

* Aleuronat appears to be the only substance which, when mixed with staphylococcus, will produce abscesses in the lower animals with any degree of uniformity. We have tried powdered peptone, pulverized sand, and salicic acid with negative results.

died on the seventh day of peritonitis. The pigs treated with mercurochrome, 2 per cent. solution, required a longer period to heal, seventeen and eighteen days. Two of the pigs of this group died on the fifth and seventh day of treatment. Where deaths occurred throughout the experiments necropsies and heart blood cultures revealed the cause as either peritonitis or staphylococcus septicæmia. The wounds of all the controls healed in from fifteen to sixteen days. The results of the experiments of series two and three were practically the same as those of the first series. It was observed that mercurophen was as efficient in 1 per cent. as the 2 per cent. solution. Also, there was practically no difference in the wounds of those guinea-pigs treated with the weaker solution of mercurophen (1:500) and with metaphen (1:500) solution. If any, the results were in favor of the mercurophen. However, compared with 2 per cent. mercurochrome and tincture of iodine, both mercurophen and metaphen (1:500) solutions were superior.

COMMENT

As previously stated, the object of this study was to determine the antiseptic most suitable for the treatment of local wounds. We were not primarily interested in the strength of the solution, except to apply them in the concentrations recommended.

Our results were uniformly in favor of mercurophen in 1 and 2 per cent. aqueous solution, as it promoted healing within a maximum time of eleven days. The metaphen compound was not as efficient as 1 and 2 per cent. solutions of mercurophen. This was probably because of the difference in concentrations of the compounds, as the most concentrated solution of metaphen obtainable was 1:500.

Although in the first series the iodine was as efficient as metaphen in the animals that live, in the second series the latter gave better results. Tincture of iodine appeared to be too irritating for the tissues and unless used with caution is harmful.

Mercurochrome solution appeared to be the least satisfactory, and in some instances delayed healing, probably because of its physical characteristics.

When the mercurochrome solution dried, a crust was formed which prevented drainage and gave opportunity for the microörganism to multiply. The inefficiency of this compound is perhaps partly because of this property and may have attributed for the death of five guinea-pigs in the three experiments.

Mercurophen and metaphen did not produce a crust and consequently free drainage was maintained. The thin scab formed in these instances was from the exudate.

Although the local application of some of these antiseptics was of value, we believe the mechanical cleansing and free drainage of the wound are more important factors in the healing process than the mere application of antiseptic solutions to already infected wounds.

SUMMARY AND CONCLUSIONS

Local abscesses were produced in guinea-pigs with staphylococcus aureus. The comparative efficiency of several popular antiseptics was determined, by daily local application, after the removal of crust and pus from the abscesses. The experiment was repeated three times with the same technic.

Our results were uniformly in favor of mercurophen (1 and 2 per cent.) solution. The other three in the order of their efficiency were metaphen (1:500 solution), tincture of iodine and mercurochrome (2 per cent.) aqueous solution.

Some of the antiseptics used delayed the healing process, as is shown by comparing with the untreated animals.

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TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY

STATED MEETING HELD NOVEMBER 11, 1931

The President, DR. JOHN DOUGLAS, in the Chair

PENETRATING ULCER OF CÆCUM SIMULATING ACUTE APPENDICITIS-ILEOCECAL RESECTION

DR. PERCY KLINGENSTEIN presented a man, thirty-six years of age, who, forty-eight hours before admission, after taking food, had an attack of nausea and vomiting which was repeated. Twenty-four hours before admission he had sharp, cramp-like pains in the region of the umbilicus which later became localized in the right lower quadrant of his abdomen. The pain was persistent and sharp, and associated with a rise in temperature to 101.5°. Prior to the present admission, he has had two previous episodes in the last five years similar to the present one. In addition he has had frequent attacks of bronchitis, cough and expectoration; no history of night sweats, afternoon fever or loss in weight.

Physical examination revealed evidences of an old tuberculous process at both lung apices. This was further substantiated by an X-ray examination of the chest which showed diffuse infiltrations in both lungs, anteriorly and posteriorly. Locally, there was abdominal tenderness over McBurney's point, and localized spasticity. A mass could be palpated in the right lower quadrant, but its outline could not be defined. The blood examination showed an absolute leucocytosis. Pre-operative diagnosis—acute appendicitis, possibly with abscess. At operation, under spinal anæsthesia, the peritoneal cavity was entered through a lower right rectus muscle-splitting incision. A moderate amount of free, slightly cloudy fluid was found. The cæcum was covered with a layer of recently deposited fibrin. The appendix was normal in appearance with the exception possibly of congestion. The cæcum upon palpation was tumified and infiltrated to about the size of a hen's egg, the infiltration appearing to occupy the entire thickness of the gut. No foreign body or perforation could be discovered. The terminal ileum was normal in appearance, as was the ascending colon. A resection of the ileocecal junction was performed with a side-to-side ileocolostomy.

The specimen removed consisted of cæcum, appendix, five centimetres of ileum and several centimetres of ascending colon. The ileum showed no gross lesion. The appendix showed a dusky inflammatory color in its distal third. At the base of the appendix near the cæcum there was an extensive ulcerative, necrotizing inflammation over an area three centimetres in diameter, a gangrenous membrane about two centimetres in diameter and minute ulcerated areas covered with a yellowish sloughing base. The wall of the cæcum was much thickened. The serosa was inflamed. The regional lymph-nodes were enlarged. An uneventful recovery followed; the patient was discharged symptom free fourteen days after operation. He has since remained perfectly well.

In 1912, Dr. H. H. M. Lyle[1] presented a similar case before this society, referring at that time to the monograph of Quenu and Duval, published in

1902: "L'Ulcere Simple der Gros Intestin." These authors reported thirty-one cases collected from the literature. In 1928, Barron[2] collected fifty-three cases. Wise[3] recently has brought the literature up to date. Of the fifty-eight cases referred to by him, forty-five had perforated. The location of the ulcers was as follows: Cæcum, seventeen; ascending colon, fourteen; hepatic flexure, five; descending colon, two; sigmoid colon, twelve; rectum, four.

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DR. JOHN E. JENNINGS had occasion recently to see a similar case in a woman from whom an acute gangrenous appendix had been removed. She made a good recovery but three months later developed a swelling in the abdominal wall. This was tender and painful deep under the superficial tissue. It was explored and adherent to the anterior abdominal wall a mass of omentum was found in the centre of which was an abscess which communicated through a perforation with the cavity of the cæcum. A resection of the cæcum and terminal ileum was accomplished with end-to-side anastomosis. The patient made a good recovery and has been well since. Doctor Jennings expressed the belief that if more autopsies were performed on fatal cases of gangrenous appendicitis many more of these associated suppurative lesions would be found in that neighborhood than are believed to exist.

DR. HERBERT WILLY MEYER said that this summer he had operated upon a young girl who had been admitted to the Lenox Hill Hospital with a diagnosis of acute appendicitis. The history and physical findings were quite typical of acute appendicitis. She had 101.5° temperature, pulse 110, total white cell count of 14,000 and 84 per cent. polymorphonuclear leucocytes. There was a tender, easily palpable mass in the region of the appendix and a diagnosis was made of acute appendicitis with abscess formation. Upon operation a perfectly normal appendix was found but through the anterior cecal wall a mass could be felt in the posterior wall of the cæcum. The parietal peritoneum close to the cæcum was œdematous and an incision was made and the retroperitoneal space easily entered. The tumor mass was found to be entirely in the posterior wall of the cæcum and could be lifted from its bed. There was no pus. Culture taken was sterile. It was decided just to drain the posterior space, which was done with a cigarette drain. For four days the wound was dry and then pus began to drain and for four weeks thick pus was discharged, after which the wound healed and the tumor mass totally disappeared. A barium clysma done some months later showed the cæcum to appear perfectly normal. Some eight years ago a similar case was operated upon in which the tumor mass was in the anterior wall of the

ascending colon and with similar drainage and similar pus discharge the patient also got well.

Dr. Charles E. Farr stated that he had operated upon two cases of ulceration of the cæcum, both acute. One was gangrenous. The ulcers were so situated that by removing most of the cæcum with the appendix and performing a plastic on the ascending colon the somewhat more formidable operation for resection of the ileocecal region could be avoided. Both made uneventful recoveries but one had an attack of acute intestinal obstruction within the year. At the second operation a thread-like band was found obstructing a loop of the ileum some distance from the ileocecal valve. This was freed and again convalescence was uninterrupted. It was interesting to note that the cecal region had a practically normal appearance after the resection. This man has remained in good health and it is now over two years since the second operation.

The etiology of this ulcerating and gangrenous lesion of the cæcum is not known. It is possible that diverticula of minute size formed a locus and a portal of entry for infection to get into the bowel wall. There is the possibility also of injury to the mucosa by foreign bodies in the fæcal mass. A microscopical study of the lesions has shed no light upon their etiology.

Dr. John Douglas said that with regard to the cause of this condition, it would seem that most of the cases here reported had had appendicitis. The only case in his own experience of ulcer of the cæcum was in a patient whose appendix had been removed. He was a small boy who was again admitted to Bellevue with appendicitis symptoms, and it was thought that there was an abscess of the stump. The boy had a small ulcer in the wall of the cæcum, which was easy to excise and close. There must be more of these cases than are reported in the records.

Doctor Klingenstein, in closing the discussion, said that drainage might have been effective but he had not been sure of the pathology. The patient had bilateral tuberculosis and Doctor Klingenstein had thought he might be dealing with some type of tuberculosis. Where the lesion is located on the anterior wall of the gut and its nature made sure of, local excision would unquestionably be the procedure of choice.

CYLINDROMA OF CHEEK

Dr. W. Howard Barber presented a case of what appeared to be an aberrant thyroid of the cheek in a boy of fourteen years of age. With a negative family and past history, the boy gave a present history of a growing mass in cheek for the past two years, and of two attempts of surgical removal. He was admitted to Doctor Barber's service, Jamaica Hospital, August 19, 1931, for observation, and discharged to follow-up clinic four days later. Physical examination was negative excepting for the local condition. The tumor in left cheek (Figs. 1 and 2) was fairly well circumscribed, involved the cellular tissue of cheek anterior to masseter muscle, was about five centimetres in diameter, hard, not tender, and although attached to

operative scar, was movable between skin and mucosa of cheek. The thyroid gland appeared normal and the basal metabolic rate was plus 14.5. The urine

FIG. 1.—J. S., boy of fourteen years, showing location of cylindroma in left cheek.

FIG. 2.—Lateral view, showing site of cylindroma.

was negative. Blood count was 4,180,000 red cells; 80 per cent. hæmoglobin; 8,000 leucocytes, with 45 neutrophiles, 3 eosinophiles, 11 large mononuclears, and 41 lymphocytes. Blood sugar was 109.1 milligrams per 100 cubic

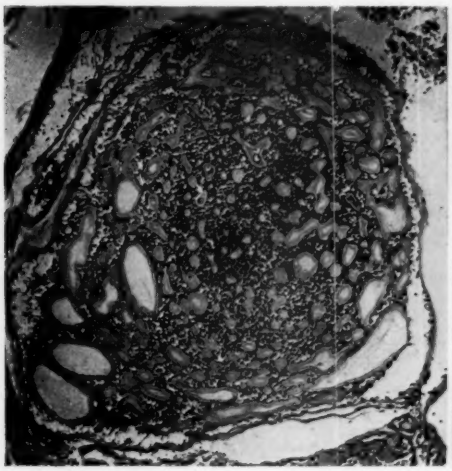

FIG. 3.

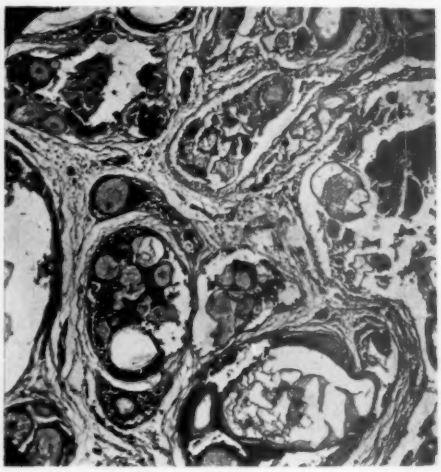

FIG. 4.

FIG. 3.—Low-power microphotograph to show a lobule composed of pseudo-alveoli at the periphery and a network of loose epithelial cells in the centre. The hyalin bodies can be seen to bear no special relation to the cells.

FIG. 4.—Low-power microphotograph to show loose areolar structure with cylindroma hyalin bodies in pseudo-alveoli resembling thyroid alveoli.

centimetres, urea nitrogen 12.3, and non-protein nitrogen 23.5; and Wassermann was negative. X-rays of bones of face were negative. The chief interest in this case was centred in the pathology of the tumor. The im-

pression of the first operator was that he was dealing with a sebaceous cyst. The description furnished by the pathologists upon first examination was aberrant thyroid. The consensus of opinion at the present time, based upon examination by several pathologists, is cylindroma.

The pathological reports follow:

Laboratory report.—Microscopical section (Figs. 3 and 4) shows spaces lined by cuboidal epithelium. These vary in size, some being round, others the size of small ducts and still others dilated. These latter show a content which in staining quality and high refractive appearance resembles colloid. This colloid-like material is present in varying proportions in the section. In the interstices between groups of epithelial acini there are foci of lymphatic infiltration. Other areas show hyalinization and fibrosis. There is no evidence of atypical proliferation to indicate malignancy. The architecture of the section, the appearance of individual cells and the colloid-like content within the alveolar lumina combining with the absence of definite secretory ducts suggests the diagnosis of *aberrant thyroid glandular tissue.*

The pathologists regard the tissue previously diagnosed aberrant thyroid as *cylindroma,* possibly originating in a salivary gland rest. Absence of characteristic colloid stain reaction excludes thyroid derivation. The concentric arrangement of oval cells surrounding hyalinized cylinders makes the second diagnosis a more probable one.

Dr. Carl Eggers related an experience he had with a case of cylindroma of the neck in a woman forty-one years of age who had come under his care in 1924. She had a painful tumor in the region of the submaxillary gland which had gradually developed during the preceding year. He believed it to be chronic inflammation due to a calculus. He was able to take out the submaxillary gland with all the fat and lymph-nodes surrounding that region. The pathological report was cylindroma of the submaxillary gland without involvement of the surrounding lymph-nodes. The patient followed a benign course for awhile but about two years later three tumors appeared on the left side of the neck. The outstanding symptom was pain. A radical block dissection of the neck was carried out, removing the three tumor masses together with all fascia, platysma, fat and lymphoid structures. The tumors were identical with the original one. The lymph-nodes were not involved.

During the following year the patient began to complain of double vision. Later her left eye became completely paralyzed, though vision remained fairly normal. There was no external evidence of recurrence but the diagnosis of an intracranial tumor was made. Prolonged X-ray treatment did not bring about a cure.

During the year 1928 several small painful nodules developed in the scar. They were excised and subsequently there was no recurrence.

The intracranial lesion, however, progressed and the patient finally succumbed five and a half years after the original operation. Permission for an autopsy was not obtained.

The outstanding symptom of this tumor was pain and the chief interest lay in the manner in which recurrences developed. The original growth was within the capsule of the submaxillary gland, and though the latter was removed with surrounding fat and lymph-nodes, metastatic tumors developed at considerable distance from it.

FIG. 6.—Radiograph showing emptying after resection and polya anastomosis for (syphilitic or tuberculous) ulcer of pyloric portion.

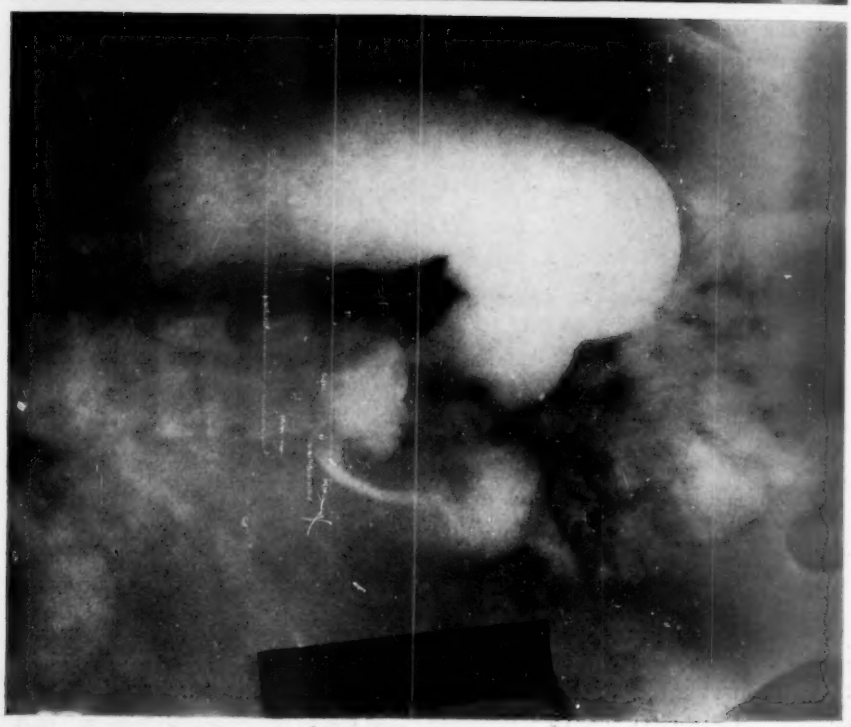

FIG. 5.—April 16, 1931. Radiograph showing defect in pyloric part corresponding to annular ulcer.

TUBERCULOSIS OR SYPHILIS OF STOMACH

Dr. John M. Hanford said that he recently had seen a child about ten months old who had a lesion in the left cheek the size of this one. It became larger and finally softened and when he saw the child the superficial sinus was ulcerated. It looked like a cyst. Last year one of the junior fellows of the Presbyterian Hospital discovered in a work by George Huntington a small group of cells described as the orbital inclusion. Doctor Hanford thought it possible that Doctor Barber's case and the one he himself had seen were neoplasms which had developed from this group of epithelial cells during the growth of the embryo. The orbital inclusion is thought to migrate from the region of the angle of the mouth toward the ear and orbit.

TUBERCULOSIS OR SYPHILIS OF STOMACH

Dr. W. Howard Barber reported a case of a colored woman of twenty-three years who entered Bellevue Hospital April 24, 1931, with the history

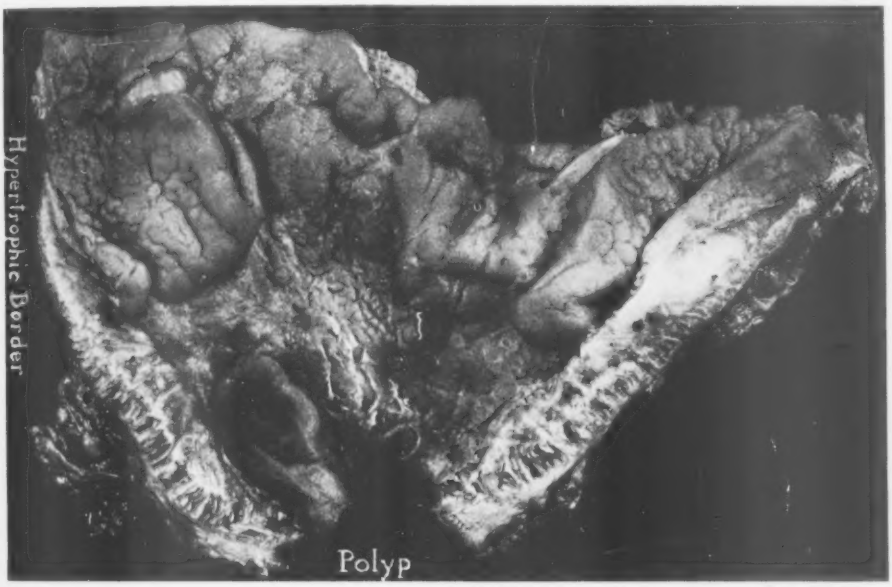

Fig. 7.—Excised stomach wall showing annular ulcer and polyp at pyloric sphincter.

of pain after meals and vomiting for the past two years. She had lost twenty-seven pounds, so that her present weight was ninety-one pounds. Respiratory and circulatory systems were negative. Vomiting occurred two hours after meals. Six months after the onset of vomiting she began to experience pain after meals. This epigastric pain began as a "fullness" which was relieved by the vomiting or by medication. Both the vomiting and pain were absent during the month preceding admission to hospital, while patient remained on a milk diet. Physical examination at this time was negative excepting for mass and tenderness in the epigastrium.

The laboratory findings.—Urinanalyses negative. Red cells, 4,770,000; hæmoglobin, 60 per cent.; leucocytes, 4,500–8,200; polymorphonuclears, 67; mononuclears, 2; lymphocytes, 29; and eosinophiles, 2. Blood Wassermann negative; spinal Wassermann negative. Colloidal gold, 122710000. Blood-pressure, 90/70–120/70. Gastric analyses

negative for blood or lactic acid and free lactic acid remained under 20 cubic centimetres for the first two hours following Boas test meal. Radiographs on April 16, 1931, and June 24, 1931, revealed "the presence of a carcinoma of the pars pylorica. No six-hour retention." (Buckstein.) (Figs. 5 and 6.) April 25, 1931, long bones reported negative for metastases.

May 9, 1931, operation disclosed an extensive ulcer of the pyloric antrum extending from the incisura to the sphincter. The regional glands were enlarged but not particularly hard, the duodenum, liver, and remaining abdomen were negative. A pylorectomy and partial gastrectomy (subtotal) were performed and followed by a posterior terminolateral gastrojejunal (Pólya) anastomosis. (Fig. 7.) Convalescence was disturbed by hæmorrhages on the fourteenth and seventeenth days, otherwise uneventful. She received four transfusions, forced fluids, antiluetic treatment and left the hospital on the first of June. September 18 she reported a gain in weight of thirty-three pounds, was symptom free, and wound in good condition. On October 12 she reported symptom free and gaining in weight.

The most remarkable feature of this case is the pathological report, which follows:

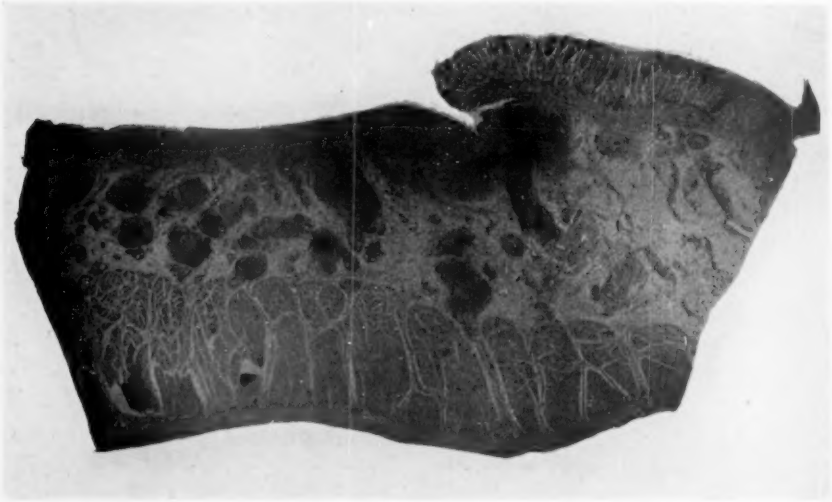

FIG. 8.—Low-power microphotograph (summar lens 35 millimetres) of edge of ulcer. Note inflammatory base with thickened submucosa of the muscularis and infiltration beneath the mucosa adjacent to the ulcer. (Photograph through the courtesy of Third Division [N. Y. U.] Pathological Service.)

Clinical diagnosis.—Annular cicatrizing gastric ulcer (gastrectomy).

Mascroscopical examination.—Specimen consists of a portion of a stomach with a small amount of omentum and two lymph-nodes which do not present any evidence of metastasis. Serosa is not injected; pyloric opening admits tip of little finger. On section, wall is thickened; submucosa œdematous; mucosa thickened. There is a spherical fresh ulceration, one and a half inches wide and extending for one and a half inches from the pyloric opening, encircling the entire stomach wall. (Fig. 8.) There is also a polyp-like tumor extending from the pyloric margin into the stomach cavity for a distance of one inch.

Microscopical examination shows scattered throughout the wall of the stomach, particularly among the muscle fibres, innumerable large and small circumscribed or diffuse collections of round and plasma cells. (Figs. 9 and 10.) In many instances these collections are arranged in the vicinity of blood-vessels, either circumferentially or eccentrically. In no instance, however, are the blood-vessel walls noticeably thickened.

nor is there any noteworthy evidence of endothelial proliferation. Among the lymphoid and plasma cells, on occasions, are to be made out solitary giant cells of the Langerhans type, without epithelioid reaction in the immediate vicinity. In still other instances the giant cells are associated with the overgrowth of epithelioid cells of the type commonly encountered in tubercles and gummata. In one slide there is a very definite circumscribed formation attended by central coagulation necrosis, arranged radiately to which are ill-formed epithelioid cells, while at the periphery are vast numbers of round cells, many of them of the plasma-cell type, others lymphocystic. The lesion represents undoubtedly either a miliary tubercle or a miliary gumma. It is impossible histologically, with ordinary stains such as hæmatoxylin and eosin, to differentiate between them. Sections are now being stained for spirochætes to exclude syphilis and for tubercle bacilli to exclude tuberculosis. It is suggested that a provocative Wassermann be done.

In arriving at a histological diagnosis in the present instance, one meets with difficulties which are practically, for the time being at least, insurmountable, for the reasons already described. As far as our experience in this laboratory is concerned, syphilitic ulcers of the stomach are extremely rare, only one indubitable case having

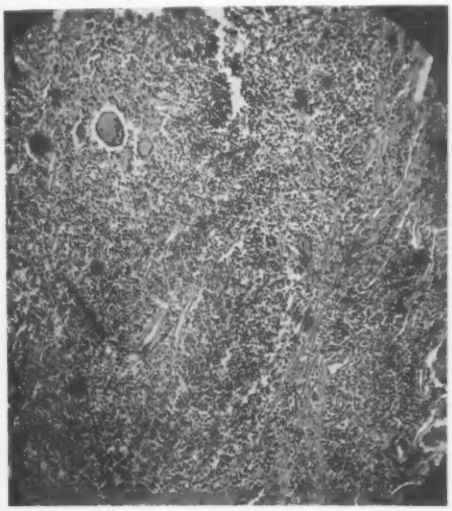

FIG. 9.

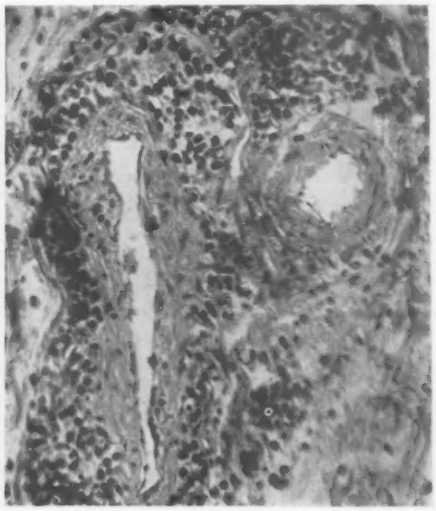

FIG. 10.

FIG. 9.—Microphotograph, low power, to show round-cell infiltration, giant-cell formation, and fibrous connective tissue in the submucosa adjacent to the base of the ulcer. Note the glandular tubules in the depth of the mucosa at the top. (Photograph courtesy Third Division [N. Y. U.] Pathological Service.)

FIG. 10.—Microphotograph, high power, to show perivascular infiltration by round cells and plasma cells. (Photograph courtesy Third Division [N. Y. U.] Pathological Service.)

been encountered among almost 17,000 autopsies. This experience, however, is not in keeping with that of certain published statements, where syphilitic lesions of the stomach are rather nonchalantly referred to as unusually common. In this laboratory we have once or twice suspected tuberculosis of the stomach, but have never been able actually to demonstrate its tuberculous nature and, as far as I know, genuine tuberculous ulcers of the stomach have never been absolutely proved to exist.

These suggestions of Doctor Symmers were carried out. Neither spirochæta nor tubercle bacilli were found by special stains. Wassermanns and provocatives were all negative. Diagnosis remained either tuberculosis or syphilis of stomach, with the probability in favor of syphilis of the stomach.

DR. EDWIN BEER said that in connection with the diagnosis of tuberculosis of the stomach the pathologists will have trouble in establishing this

unless they are able to identify the Koch bacillus in the tissues. A few years ago (ANNALS OF SURGERY, vol. lxxiv, p. 245) the speaker showed a case which Doctor Symmers had reported to be tuberculosis without finding the Koch bacillus in which the gross and microscopical specimens seemed identical to the picture Doctor Barber showed this evening. The diagnoses of tuberculosis in Doctor Beer's case, and of lues with a question as to tuberculosis in Doctor Barber's case, were surprising. Both lesser and greater curvatures in Doctor Beer's case were covered with glands and adjacent to the huge ulcer the mucous membrane was undermined just as one sees in tuberculous ulcers of the alimentary tract.

DR. RALPH COLP said that in 1927 he presented before this society a case of tuberculous ulcer of the stomach in which at the time of operation an ulcer was found at the reëntrant angle of the stomach, and surmounting this a mass of caseating nodes which had to be excised before the gastric artery could be ligated and a subtotal gastrectomy performed.

It was, however, impossible to recover tubercle bacilli from the glands or to find them in the specimen. The pathological picture, however, was typical of tuberculosis. This patient, a Negro, made a good operative recovery, but one month later developed an effusion into the right chest which revealed the presence of tubercle bacilli. Since then the patient has been well and has gained forty pounds in weight. It is thought that some of these tuberculous ulcers of the stomach develop secondary to retrogastric nodes infected by a retrograde lymph flow from the tuberculous glands about the hilus of the lung.

DR. CHAS. GORDON HEYD thought that this case of Doctor Barber's illustrates the difficulty in the differential diagnosis between tuberculosis and syphilis of the stomach. If one should judge from the reports in the surgical literature, it would seem that gastric syphilis is a common condition. It is however, the considered judgment of pathologists that definite syphilis of the stomach is a comparatively rare disease. In a series of 18,000 gastro-intestinal examinations, the röntgenologic diagnosis of syphilis of the stomach was made in only five cases. In the combined surgical services of three attendings at the Post-Graduate Hospital in three years, the operatively removed material permitted a diagnosis of syphilis of the stomach in only three cases. In the first case at operation there was enlarged right lobe of the liver, presenting many stellate scars and apparently there was no liver substance to the left of the round ligament. In the second case, the pathologist, very much like Doctor Barber's case, could not definitely decide between tuberculosis and lues, and the third case was definitely placed as syphilis of the stomach in spite of negative Wassermanns. It seemed to Doctor Heyd, therefore, that lues of the stomach is both infrequent and from a pathological point of view occasionally extremely difficult to diagnose.

DOCTOR BARBER, in closing the discussion, said that sections had been stained for tubercle bacilli and for spirochæta, but none had been found. In as much as spirochætes of buccal origin might appear in a stomach section their existence in a stained section did not prove a syphilitic lesion. In this case the regional glands were enlarged but not as hard as in carcinoma. Regarding the rarity of syphilis and tuberculosis of the stomach, Doctor Symmers had indicated in his report the incidence of the former to be one in 17,000 autopsies and that of the latter to be more infrequent.

BILIARY FISTULA—TRANSPLANTATION INTO STOMACH

DR. W. HOWARD BARBER presented a woman of forty-six years who was admitted into Bellevue Hospital February 28, 1931, and discharged April 10,

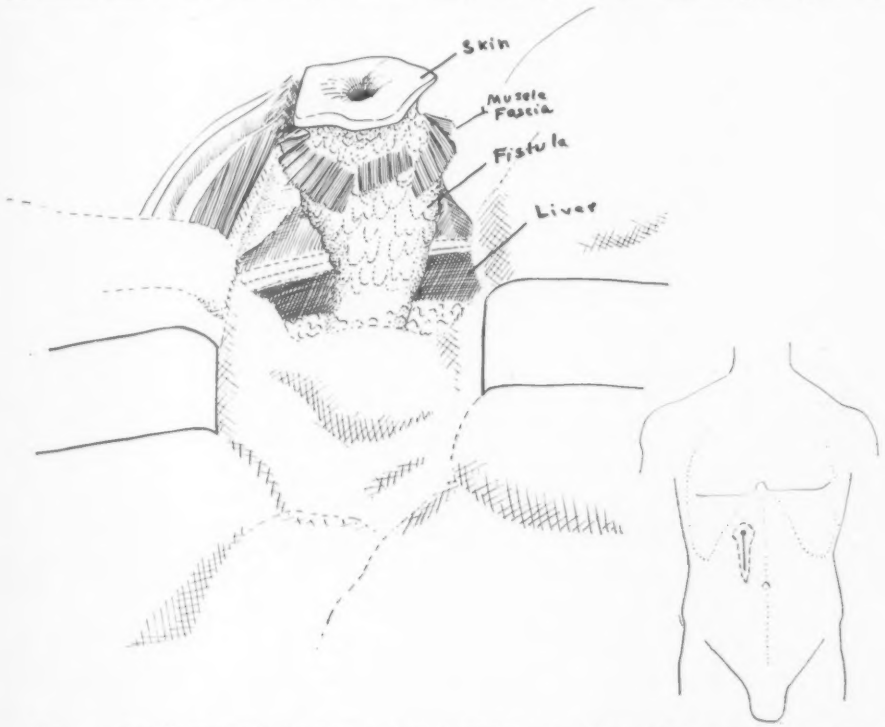

FIG. 11.—Semidiagrammatic drawing to show dissection of a biliary fistula from skin surface to border of liver. Note attached flap of skin, muscle, and fascia purposely left intact to serve as a barrier for suturing fistulous tract to stomach. If the incision in the stomach is kept small, the edges of wound snugly fit behind skin flap, and mechanically prevent retracting. Insert shows incision in skin.

1931. She was a multigravida; had had frequent attacks of epigastric pain radiating to right costovertebral angle during the past eighteen years. Eructations, vomiting, and pain without jaundice of any definite degree continued to time of first admission. Physical examination was negative excepting for tenderness in the right hypochondrium. Cholecystography negative. Wassermann negative. Blood sugar, 115 milligrams per 100 cubic centimetres. Non-protein nitrogen, 33. Operation, performed March 16, 1931, revealed a chronically thickened and functionless gall-bladder containing many firmly imbedded stones. Stones were found in the right hepatic duct at hilum of liver. No bile was obtained. There were many adhesions, enlarged hilum

nodes, and a thickened pancreas. Liver was normal in size and appearance. Spleen was normal in size and high in abdomen. The gall-bladder was dissected away from liver, incised down to cystic duct; stones were removed from bladder and from duct, but some calculi undoubtedly remained high in hepatic duct, and bladder was excised. Rubber (Mayo) tube sutured to cystic duct and two cigarette drains were left *in situ*. The pathological report by Dr. D. Symmers was chronic cholecystitis with cholestrinization of wall; cholelithiasis. On the third post-operative day bile was observed from the tube; on the seventh day the amount was oz. iiss; and jaundice was noted. On twenty-fifth day, patient, still discharging, was referred to out-patient department. Three weeks later, she was re-admitted (May 18, 1931) with complaint of persistent biliary fistula. Lipiodol injected into fistula "reveals a large amount of opaque mixture for a distance of about 3 inches opposite the second and

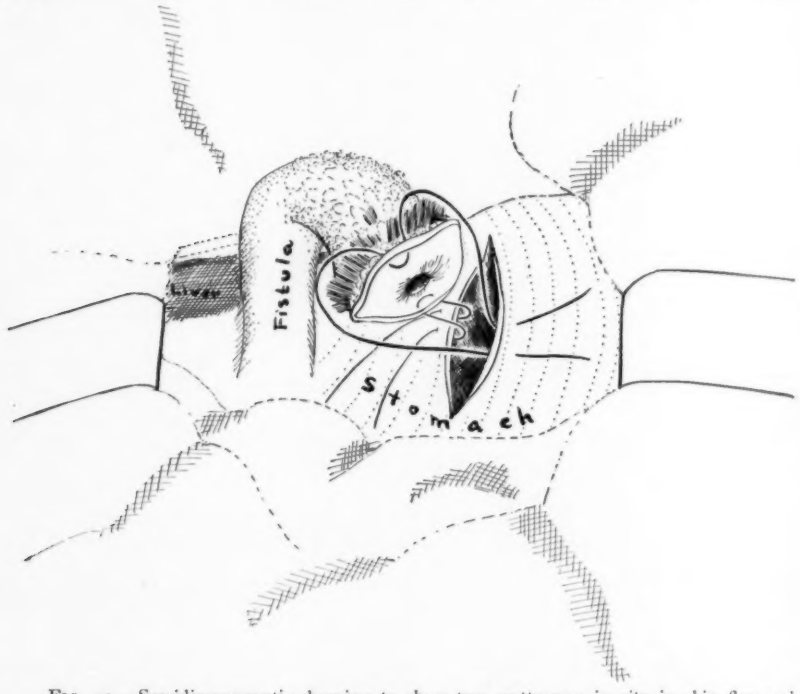

FIG. 12.—Semidiagrammatic drawing to show two mattresses *in situ* in skin flap and in stomach wall—being used as tenacula to draw the fistulous tract into the opening in stomach. The sutures, when tied, serve an important factor in fixing the stomach and in preventing retraction of the fistula. The "tabs" of muscle and fascia at neck of fistula become useful "holds" for inverting sutures from the gastric wall.

third lumbar vertebræ on right side. The fistula extends apparently in the region of the gall-bladder." June 24, 1931: "No organic lesion of stomach or duodenum. Gall-bladder not visualized."

On May 26, 1931, three months after first operation, operation revealed a well-organized fistulous tract extending from upper end of operative scar to site of former gall-bladder. No stones palpated. No enlarged glands. Liver pale and yellowish. Many adhesions between liver, stomach, and omentum. Fistula was dissected out together, with a plaque of skin four centimetres in diameter to the liver border. (Fig. 11.) The falciform ligament was divided and pyloric end of stomach mobilized so as to bring the antral region in apposition with mouth of fistula. (Fig. 12.) The skin flap bearing the external fistulous opening was inserted into antrum through a three-

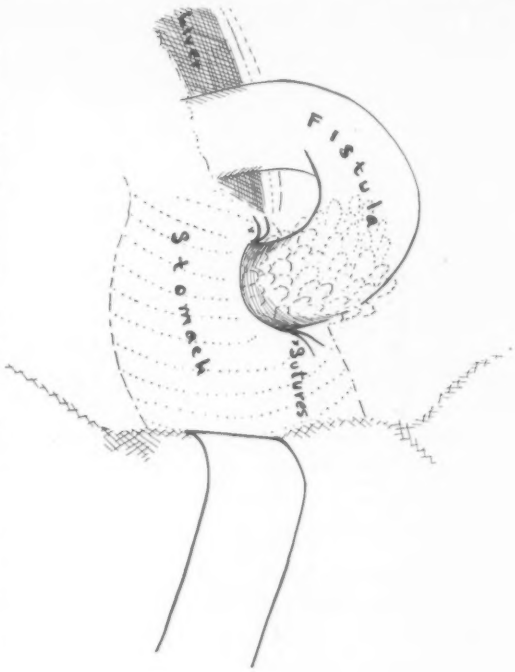

FIG. 13.—Semidiagrammatic drawing to show the transplantation of a biliary fistula into the stomach. Purse-string sutures left long to indicate inversion of the stomach.

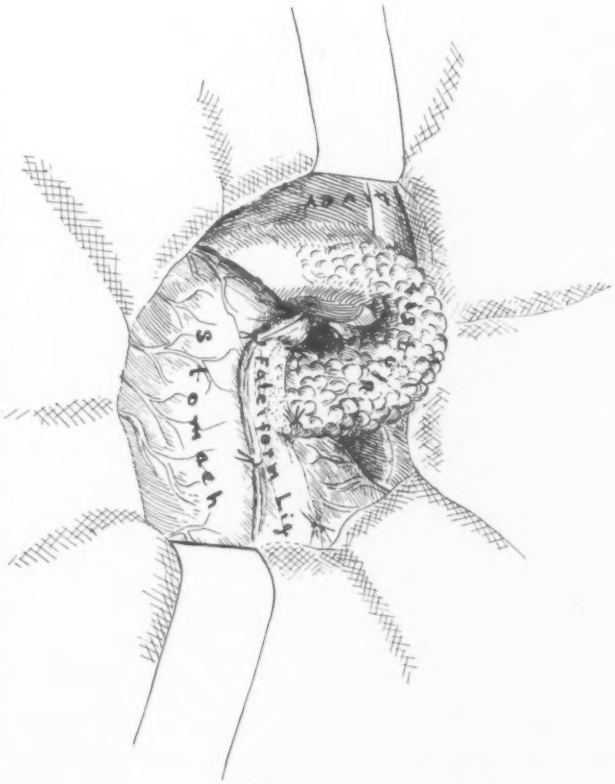

FIG. 14.—Semidiagrammatic drawing to show the utilization of the falciform ligament to protect suture line and to guard against separation of fistula and stomach. The ligament is divided along the attachment upon the abdominal wall and this end is laid about anastomosis. The hepatic end is perfectly located to steady the anastomosis.

centimetre vertical incision and stomach was sutured and inverted with interrupted chromic sutures about implantation. Falciform ligament was divided at mural end and was sutured about anastomosis; cigarette drain was left in upper angle of wound below anastomosis. (Figs. 13 and 14.) Wound was closed in layers with chromic gut and silkworm. During the convalescence the patient discharged bile and gastric juice for the first few days. During this interval the maintenance of an intragastric tube, frequent aspiration of gastric contents, abstinence of feeding by stomach, clyses, and transfusions carried the patient over until she was able to take food by stomach. She was discharged June 6, 1931, in good condition, with wound healed. She has been symptom free on a regular house diet and been able to resume her duties as housewife for the past four months.

Of special interest in this case is the utilization of the relatively simple operation of fistula transplantation for a sick patient with inaccessible ducts, no gall-bladder, probable hepatic stones; for a patient who developed pain and temperature if the external bile drainage was temporarily stopped; and of additional interest is the normalcy of gastric function secretory and motor, in the presence of bile.

Dr. Howard Lilienthal said that some time ago he had presented a patient on whom he had operated by the same technic as that used by Doctor Barber and a beautiful recovery followed. Doctor Lewisohn assisted him. The patient remained perfectly well and had no jaundice, but nine years afterward returned to the hospital with symptoms of pyloric obstruction. Gastroenterostomy was performed and improvement followed. Before she left the hospital an incision was made under local anæsthesia and a specimen removed with a Mixter's cannula punch and it proved to be carcinoma. She died shortly afterward but no post-mortem was permitted. Doctor Lilienthal wished to emphasize the point made by Doctor Barber of leaving the button of skin around the fistula so that when it is in the stomach it will not tend to slip out again. It would, however, have been interesting to find out if this had anything to do with the resulting carcinoma in his case.

Dr. Otto Pickhardt said that Doctor Lilienthal's was the second case in which this technic was employed; Doctor Williams, of Boston, did the first and Lahey the third. Murphy, of Chicago, did one, but his case was not successful. It is not a difficult operation but several points should be kept in mind. The core should be large to leave a good broad supply to transplant the sinus, and Lahey recommends that the skin at the other end be taken off. He advises that a small loop be inserted into the sinus. The addition of the small opening in the stomach is of great help as one can see how far the sinus is in the stomach. There was no leakage in Doctor Pickhardt's case and the patient has made an uneventful recovery. About 50 per cent. of these cases do show a most obstructive form of jaundice which usually disappears on the second or third day.

Dr. William Barclay Parsons, Jr., referring to the point about dissecting out the tract, said that about four years ago he operated on a case in

which he made a too free dissection of the tract and the anastomosis broke down. Last July he had another case and adopted the procedure mentioned by Doctor Pickhardt, removing the button of skin and using a small tube for anastomosis. The stomach was attached to the under surface of the liver by adhesions, producing an anastomosis of the posterior half of the tract to the stomach, so it was merely a question of uniting the anterior half of the tract to the stomach.

Dr. Thomas H. Russell referred to a patient on whom he recently operated in whom the fistulous tract had to be utilized as the common duct. The patient had undergone a cholecystectomy two days before the speaker saw her; at that time she was distinctly jaundiced, the urine contained a moderate amount of bile and the icteric index was 56. Doctor Russell advised exploratory operation as he felt sure there had been an injury to the common bile-duct. That afternoon he opened the abdomen through the incision which had been made two days before and found a ligature had been placed around the common bile-duct at the junction of the cystic duct. When the ligature was released a gangrenous area was noticed on the anterior surface of the duct extending upwards about three-quarters of an inch. The duct was opened and a T-shaped tube introduced. The patient made an uneventful recovery, but at the end of three weeks the tube accidentally slipped out. The wound healed very quickly and she remained well for several weeks, until she came to Doctor Russell again, suffering from severe jaundice, clay-colored stools and a large amount of bile in the urine. April 4 he re-operated upon her and found there was a stricture involving about three-quarters of an inch of the common bile-duct which was completely occluded. The stenosed part of the duct was excised and the two ends of the duct brought together over the T-shaped tube which was allowed to remain in place for six months in order to have a well-organized fistulous tract form around the tube. Care was taken to have this tube come out of the abdomen along the posterior wall and upper surface of the stomach. About six weeks ago Doctor Russell operated on her again and dissected the fistulous tract free down to the stomach, then made an incision parallel to the stomach across the anterior wall and palpated the T-tube through the posterior wall of the stomach. At this point an incision was made through the posterior wall of the stomach into the fistulous tract and the end of the tube that had been exposed on the abdominal wall was pulled through into the stomach. The end of the tube was cut off so as to leave only about one-quarter of an inch protruding into the stomach. The patient made an uneventful recovery and, up to the time she left the hospital, which was about three weeks after operation, had not passed the tube. Doctor Russell believed this was a better and safer operation than trying to anastomose the excised fistulous tract into the stomach.

Doctor Barber, in closing the discussion, said that he regarded the use of the skin flap as very important in the technic of fistula transplantation.

There need be no fear concerning the future of the transplanted tissue exposed within the stomach to the gastric secretion, for experience with cholodochoduodenostomy indicated that such devitalized tissue completely disappeared within a few days (often three days). During this interval the intramural segment becomes vascularized and fixed, making retraction very much less likely. It seemed wise also in dissecting out the tract to leave it somewhat "bulky" to preserve the lumen of the fistula and to facilitate suturing. In this type of case, he thought the stomach would often be found adherent to the right and close to the under surface of liver.

MEDIASTINAL TUMOR. REMOVAL BY TWO-STAGE OPERATION

Dr. Frank S. Mathews presented a woman, aged thirty, who came under observation a year ago. She was a strong, healthy-looking woman who said she had had slight hoarseness for seven or eight years. The right vocal cord was found partially paralyzed. There was a mild Horner's syndrome, that is, the right pupil at times contracted, and there was at times slight narrowing of the palpebral fissure. The right lower and upper arm was larger in circumference than the left by about one and one-half centimetres. The veins below the clavicle in the right chest were conspicuously dilated. There was a slight fullness above the clavicle. Nothing else noted in the neck. The X-ray examination of the chest showed a globular mass extending from the apex to the third rib anteriorly and from the mediastinum outward to the right lateral wall. The mediastinum was not displaced and the trachea was almost median. Breathing sounds could be heard both anteriorly and posteriorly to the top of the chest though diminished. There was dullness but not flatness in this same area. The pre-operative diagnosis was a probable dermoid originating in the upper mediastinum and growing outward into the right chest. It was decided to attempt removal in two stages with the hope of not opening, or at any rate, not infecting, the right pleura.

The first operation was performed October 27, 1930, under gas ether, with provision for positive pressure. A curved incision was made at the costosternal junction beginning at the third rib, running upward beside the sternum and outward under the clavicle. The pectoralis was split and separated from the second and third ribs. Three and one-half inches of the second rib were removed from the cartilage outward. The pleura was not opened. The inner margin of the lung could be seen moving up and down to just this level. The tumor could be palpated above the lung margin. It felt tense and hard, possibly cystic. Two and one-half inches of the third rib were then removed. The intercostal muscle between the two ribs was divided. Iodoform gauze was packed tightly down on the pleura, pushing the lung margin down as far as the third rib. The wound was closed tightly over the packing.

Following this operation, the patient ran a fairly high temperature for a few days with diminished and later seeming distant breathing. On subsidence of the temperature the physical signs did not suggest a resolving pneumonia. X-ray on the third day showed diffuse clouding of the entire right chest, the heart being drawn a little to the right. The condition was considered an atelectasis, especially as there had been considerable early cyanosis.

Note.—Doctor Barber gratefully acknowledges the helpful coöperation of Dr. Irving Graef, of Doctor Senior's staff, for the preparation of the foregoing microphotographs.

At the time of the second operation, eleven days after the first, the clouding of the right chest had largely disappeared. It had not been the intention to make the interval between operations so long. Under gas the wound was opened and the gauze pack removed. The cut ends of the second rib were identified and the tumor aspirated. Clear, straw-colored fluid was evacuated containing what was considered to be glistening cholesterin crystals. An incision was made through the agglutinated pleural surface in the bed of the second rib and a tumor capsule clearly defined. Digital dissection was then carried out, the dissection proceeding along the outer, upper and lower aspects of the tumor, at first avoiding its mediastinal aspect. The fluid had been entirely evacuated and the blunt dissection proceeded with until the mass was largely delivered and still adhered to the mediastinum between the pulmonary artery and the sternal. Here cutting instruments were used to some extent. The pleura was not opened. Bleeding was very moderate and the lung expanded upward, considerably diminishing the size of the cavity. The amount of oozing seemed to make it unwise to close without any drainage so a rubber dam drain was inserted through a stab wound in the breast and the original incision was closed.

The tumor had a cystic centre, fairly firm fibrous capsule and there was a considerable mass of tissue which on frozen section was reported thyroid. There was no evidence of thyroid tumor in the neck. Wound healing was satisfactory, as was her entire convalescence. She was not nearly so ill following the enucleation as after the costectomy.

It is an interesting question as to whether the operation could have been done at one sitting, but it is to be remembered that the nature of the tumor was quite a surprise. It was believed to be a benign tumor, very likely dermoid or possibly fibroma. She has been well and working for the past ten months.

Dr. Carl Eggers said that no single surgeon has had a large group of these cases and it is not possible to make general statements. A mediastinal tumor of the size described by Doctor Mathews is a serious condition and good judgment is required to bring about a cure. The question of time is not very important. The object must be to avoid complications, and this is best done by doing the operation in two or more stages. Each case must be judged individually. To have been able to remove this large tumor in one sitting after a preliminary operation for the purpose of proper exposure and formation of adhesions, without opening the pleura or damaging mediastinal structures, speaks well for the judgment and skill displayed.

OBSTRUCTION DUE TO ILEAL IMPACTION

Dr. Frank S. Mathews presented a boy, ten years of age, who came under his care August last. From the age of three he had had attacks of pyelitis with complete recovery between. Four weeks before, in the country, he suffered from pain in the right hip and thigh and walked lame. His temperature once jumped to 104°. A single blood count showed 7,000 cells. X-rays of the hip and thigh on two occasions were negative. The symptoms subsided. Two weeks or more before he had a severe urticaria which affected the skin and larynx, and was relieved by adrenalin. When this developed he had been taking atophan. Thereafter he was on a restricted diet and seemed well, exercising vigorously. Two days ago he ate abundantly of green corn. One day before had pain in the abdomen but no temperature. Cathartic was

administered but vomited. During the last night he vomited at frequent intervals. This morning an enema brought a few fecal particles. Another enema just before he was seen returned clear with strings of mucus. Temperature was 102½°. Five hours before operation the boy was flushed, tongue moist, not perspiring, restless, turning from side to side, alert when awake but seemed disposed to sleep. Water had been withheld and there had been no vomiting for several hours. The abdomen was definitely distended. There was abdominal pain but not very severe. No peristalsis seen or heard. No definite point of tenderness. No rigidity. Continued pressure on the lower abdomen seemed grateful. There was tympany over the mid-abdomen and very definite shifting dullness. A blood count made shortly before operation showed 15,000 leucocytes, 71 per cent. polymorphonuclears. The urine was negative. Just before operation temperature reached 104.2°. He was restless, appeared tired, pulse frequent but of good force. He had retained a few sips of water and distention had increased. There was no tenderness in upper abdomen and slight in the lower. Polymorphonuclears increased to 76 per cent. He was thirsty. The history seemed confusing and rather complicated. It rather suggested obstruction. There was absence of appendix history or local tenderness. Distention, free fluid, high fever and moderate leucocytosis suggested an idiopathic peritonitis. Prostration was not marked. Exact diagnosis seemed uncertain but operation seemed urgently indicated.

A right rectus incision was made and an abundance of straw-colored fluid evacuated. Distended but otherwise normal coil of small bowel presented. On exploration a sausage-like mass was felt in the right lower quadrant and pelvis. The first thought was of an intussusception. The terminal ileum and cæcum were readily delivered. The cæcum was empty. The terminal ileum for at least eight inches was distended by a mass of putty-like consistency with some harder particles. This portion of bowel was moderately injected with slight ecchymoses. Just at the ileocecal valve the bowel seemed rather œdematous. By manipulation the contents of the lowermost ileum were expressed into the cæcum, after which the remaining putty-like mass was rather easily displaced downward with a resulting balooning up of the cæcum. Cæcum and ileum were then reduced into the abdomen and wound sutured.

Four days later it was noted that enemas brought hardened fæces, but today's brought only gas. At times he passes gas and much came with the enema but distention has never entirely disappeared. Temperature has rather promptly subsided. The urine output is good. He takes only fluid, seems hungry, but vomits at irregular intervals. On the fifth day a stomach tube was passed and evacuated eight ounces of fluid which did not seem intestinal in character. Clysis of saline and glucose was given. No vomiting during the night. Took water and tea this morning. Two days later, following an enema and pituitrin, he began to have loose bowel movements. This relieved his distention and vomiting disappeared and he began to retain for the first time fluid nourishment. He remained several more weeks in the hospital, at times with moderate fever, with tendency to distention, occasional vomiting, usually stating that he was hungry but satisfied with a few mouthfuls of food. An X-ray of the abdomen about ten days after operation, with bismuth injected into the rectum, showed the colon well outlined in bismuth, and, in addition, coils of small intestine much distended with gas.

Doctor Mathews said he had neither seen nor heard of any case in which an obstruction of the small bowel in a child was due to fecal impaction.

CONGENITAL HYPERTROPHIC PYLORIC STENOSIS IN INFANCY

DR. EDWARD J. DONOVAN read a paper with the above title for which see page 174.

DR. MORRIS K. SMITH said that he thought that the pre-operative care, the judgment in selecting time for operation and the post-operative treatment as so successfully carried out on Doctor Donovan's service should be particularly emphasized. Surgeons are learning more and more that careful attention to these matters is essential if the best results are to be attained in surgery. That Doctor Donovan's last 100 cases have included but one fatality is a triumph of judgment and skill in the management of this condition. The fatal case occurred two weeks after operation from gastro-enteritis and is not a complication of the operation itself but rather of the infant's rundown condition. In the speaker's personal experience fatalities have been of this type rather than due to the operation itself.

After operation there may be no further vomiting, although many of the infants will throw up occasionally in the first week or more. This was formerly a cause of concern lest the pyloroplasty had not been sufficiently thorough, but as the outcome has been universally favorable there is no cause for worry on this account.

As Doctor Donovan has brought out, spasm is an important factor in pyloric stenosis of infants. Doctor Smith had a patient who on radiography showed not only gastric retention but cardiospasm as well. Following a pyloroplasty the infant made an uninterrupted recovery and had no symptoms referable to the cardiospasm.

DR. FRANK S. MATHEWS said that some years ago he reviewed his cases of pyloric obstruction in infants and analyzed them by means of graphs which gave considerable information. The onset was reported sudden in two-thirds of the cases. The age at onset varied from birth to ten weeks, the average age at onset being three weeks. The duration of symptoms at the time of operation ranged from three days to nine weeks. The age of the patients at operation varied from three weeks to twelve weeks, the average age being seven weeks. Thus, if the average age at onset was three weeks and the average age at operation seven weeks, it is shown that four weeks are consumed in making a diagnosis, deciding that operation is necessary and persuading the parents to that effect. It would seem that this time might be considerably diminished with advantage to the patient. There were more children who were breast-fed than formula-fed. The chief importance of this observation lay in the fact that the average breast-fed child remained in the hospital thirteen and a half days while the formula-fed infant remained twenty-two days. The late Dr. Emmet Holt was a good teacher. Fifteen years ago he told Doctor Mathews to sit down and he would tell him how one makes a diagnosis in these cases. He said there were four means of diagnosis and he would state them in the order of their importance. "First in importance," said he, "is the history. Second, the peristaltic waves in

the upper abdomen beginning at the left and passing to the right. Third, is the gastric residue determined by passing a catheter into the stomach just before a feeding time; and fourth, there is the palpation of a tumor." The latter he thought not of great importance. Some consider the feeling of the tumor as of the greatest importance. He thought it probably dependent on the experience of the surgeon in palpating the abdomen not only of these cases but having a background of experience in palpating the abdomen of a considerable number of patients without a tumor.

Doctor Lewisohn remarked that a mortality of 1 per cent. among 100 consecutive cases of Rammstedt operations was the best proof not only of Doctor Donovan's technical skill, but of his good judgment in handling these infants. He was glad to see that Doctor Donovan made extensive use of blood transfusions. He had always felt that blood transfusion was not used often enough in the pre-operative preparation of bad surgical risks. He had performed the Rammstedt operation upon twenty-seven cases of congenital pyloric stenosis between 1917 and 1928. He had no opportunity to perform this operation during the last three years. He lost six cases among thirteen patients. Among the last fourteen cases he had no operative death, though one baby died about three months after the operation from a gastro-enteritis. He was a strong believer in the superiority of breast milk as compared with artificial preparations (thick cereals, *etc.*) in the after-treatment of these babies.

Doctor Donovan had pointed out that congenital pyloric stenosis occurs very rarely in the female. The similarity of the sex distribution in congenital pyloric stenosis and in gastroduodenal ulcers is very evident. It is certainly very interesting that the tendency to inflammatory diseases in the pyloric region is not only apparent in the male adult, but in the male baby—an interesting analogy. (See Lewisohn: Gastroduodenal Ulcers. Jour. Am. Med. Assn., vol. lxxxix, p. 1649, 1927.)

Dr. Edward W. Peterson said that infantile pyloric stenosis was described by Armstrong, in 1777, and by Beardsley, in 1778. Hirschsprung wrote on the subject in 1888. In 1898, Cautley could find a record of but twenty cases. By 1902, there had been recorded on the literature fifty cases, nineteen of which had been subjected to operation. At this time gastroenterostomy was the operation of choice, but the mortality was so high that few physicians cared to recommend surgical treatment. In 1910, Fredet suggested an operation, and in 1912, Rammstedt and Fredet published almost simultaneously articles describing a new method of pyloroplasty, which has since revolutionized the treatment of this condition.

In the abdominal surgery of infants three conditions in frequency and importance outweigh all other surgical diseases, namely: Congenital hypertrophic pyloric stenosis, acute intussusception, and acute appendicitis. All three were in former years regarded as emergency conditions calling for immediate operation. While the latter two should still be kept in the emergency class, cases of infantile pyloric stenosis should never be operated upon

until tissue desiccation, chloride depletion and starvation symptoms have been overcome by the administration of glucose and saline solutions, and by blood transfusions in selected instances. Years ago Strauss emphasized the importance of preliminary preparation, and more recently Clopton called attention to the necessity of overcoming the alkalosis which is present in these cases, before any operation is performed. There is no question but that an ounce of proper pre-operative treatment is worth pounds of post-operative effort.

Dr. Charles E. Farr said that his own personal experience of a very modest number of cases was similar to that of Doctor Donovan's, in that his earlier cases gave a high mortality, running over 30 per cent., whereas his later cases all did well.

Doctor Farr has a predilection for local anæsthesia for these operations as it allows plenty of time for the careful technic necessary. The administration of ether to these little babies certainly requires exceptional skill in the anæsthetist and such skill is not always available. He considered about 90 per cent. of the problem of congenital pyloric stenosis to be medical in its nature. A very large proportion of these babies can be relieved entirely by medical means. Another large proportion can be tided-over their crises by medical means but with great difficulty and expense. A third but much smaller group seems to be definitely surgical from the onset of symptoms.

Doctor Donovan, in closing the discussion, said that many of these babies vomited once or twice after operation but that was nothing to be alarmed about. Much as he disliked to disagree with Doctor Mathews, the speaker believed it was essential to the diagnosis to feel a tumor. In his three cases of mistaken diagnosis, there was some real reason why these cases did not receive the usual careful abdominal examination. For example, one case arrived at the hospital with a gastro-intestinal series showing a twenty-two hour gastric retention. The man who asked me to see this case with him thought that he felt the tumor and I thought I did, but I am sure we were influenced by the X-ray findings. Another case had been examined before I saw it by a man who has done a great many of these cases. He was very certain that he felt the tumor and this again probably influenced me. He was sure these three cases were cases of pylorospasm which no doubt give a similar picture except for the tumor. This is why he felt sure that the tumor could always be felt if one took the time to do a painstaking abdominal examination. For the same reason he felt that if one did not make the palpation of the tumor one of the diagnostic signs many cases of pylorospasm which have no tumor at operation would be subjected to operation.

PERINEPHRITIC ABSCESS WITH RUPTURE INTO BRONCHUS—NEPHRECTOMY

Dr. Percy Klingenstein presented a man, sixty-two years of age, who was admitted, about a year ago, to the service of Dr. A. Hyman at the Beth Israel Hospital, with chief complaints of pyuria for seven months, some dysuria, and attacks of left lumbar pain of three or four weeks' duration

just prior to admission. His past surgical history consisted of suprapubic cystotomy for vesical calculus followed by prostatectomy at Mount Sinai Hospital six years ago, and a posterior gastroenterostomy and pyloroplasty for duodenal ulcer at Beth Israel Hospital two years ago. He was an elderly man, thin and poorly nourished, appearing chronically ill. Abdominal palpation showed the presence of a large palpable left kidney with marked left costovertebral tenderness. X-ray examination of the urinary tract showed several large cuneiform calculi in the pelvis of an enlarged left kidney. Examination of the urinary tract with the aid of uroselectan showed a markedly diminished function on the left side with a normally outlined pelvis and calices on the right. Cystoscopy showed frank pus coming from the left kidney with a normal secretion and normal function from the right. Blood chemistry was within normal limits. Hæmoglobin, on admission, was 57 per cent., 3,500,000 red blood-cells. Urine examination showed a specific gravity ranging from 1014 to 1020 with many red blood-cells and white blood-cells in the sediment. After a preliminary transfusion, and under spinal anæsthesia, the left kidney was exposed through a loin incision. The kidney was found to be enlarged to about three times its normal size and completely surrounded by a massive perinephritis, to which the colon was intimately adherent. In attempting to mobilize the kidney, a large collection of foul-smelling pus was entered.

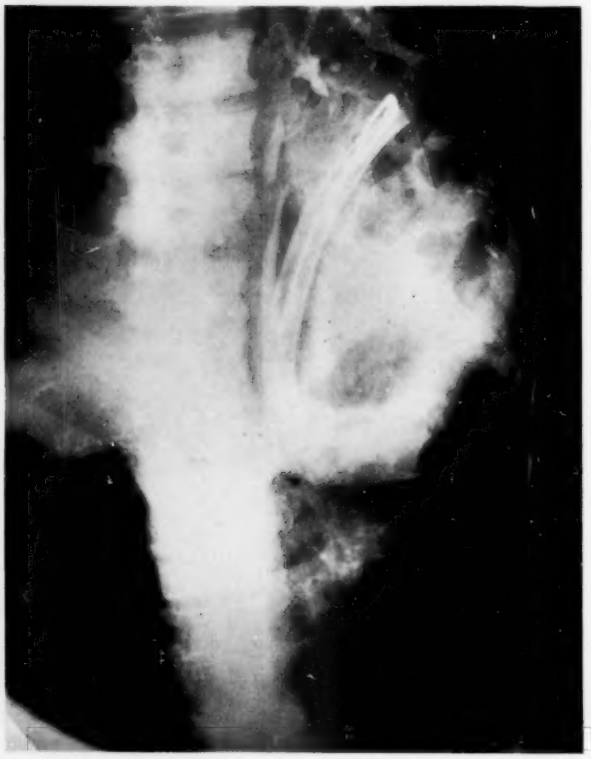

FIG. 1.—Skiagraph showing sinus tract outlined with lipiodol.

In view of the patient's poor condition, it was deemed advisable to drain the perinephritic abscess rather than attempt what would undoubtedly have been a very difficult nephrectomy. The abscess cavity was drained with two rubber tubes and the wound loosely sutured. Following this procedure the patient ran a low, irregular temperature, which was persistent. Thirty-two days following the first operation, during a routine irrigation of the wound with acriflavin, patient experienced a paroxysm of coughing and it was noticed that he coughed up large quantities of yellow-stained watery fluid. It was evident that the patient had a communication between the perinephritic abscess and the bronchial tree. In an attempt to establish this, the sinus was outlined with lipiodol. (Fig. 1.) The patient's general condition, in spite of the absence of retention, was becoming poorer. It was thought that the infection in the kidney was the source of the chronic sepsis, and it was de-

termined to perform a nephrectomy. This was done under nitrous oxide and oxygen anæsthesia after removal of the twelfth rib. The kidney capsule was incised, shelling an enlarged kidney out of its capsule, first anteriorly where pus was encountered and then posteriorly. Both poles of the kidney were then mobilized and after separating the upper pole a definite blow was heard coming from underneath the region of the diaphragm. The pedicle was identified and ligated. Following removal of the kidney, the wound was left open and a large Mikulicz tampon was inserted. The specimen consisted of a ruptured kidney, the pelvis filled with soft greenish concretions. The surface was studded with small cysts. The pelvis and calices were distended and filled with seropurulent material.

Following the second operation, the patient's temperature gradually subsided; the wound became clean and granulated slowly. The fistula closed spontaneously. The general condition of the patient continued poor. There was marked emaciation and a profound secondary anæmia, not influenced by blood transfusion, and for which no cause could be found. Examination of the gastro-intestinal tract showed the presence of an old duodenal ulcer but failed to reveal evidence of carcinoma. At this time his weight dropped to eighty-six pounds. Two weeks after the temperature became normal, he began to gain weight, gaining fourteen pounds in two weeks. Patient discharged thirteen weeks after admission. At present his wound is healed, he has gained considerably in weight, and feels perfectly well.

Extension of perinephritic suppuration into adjacent viscera with the production of internal fistula has been recorded much more frequently than rupture of such a collection into a bronchus. The latter would tend to occur more often on the left side where the liver does not act as a defending barrier.

REMOVAL OF INTERNAL MENISCUS OF KNEE

Dr. Percy Klingenstein presented a woman, twenty-two years of age when first seen by him three years ago. At that time she complained of pain and disability in her left knee-joint. Her first symptoms dated back five years prior to that time as the result of an injury sustained in a game of basketball, when she was thrown to the ground with the knee in a position of flexion and internal rotation. There was also a history of typical locking on the outer side of the joint, where there was tenderness. She was then operated upon, and the left external meniscus removed through a left lateral incision. She was symptom free until she consulted the reporter. While she was relieved for a time, she then noticed that she had a recrudescence of her former symptoms but the symptomatology seemed to have shifted from the external to the internal aspect of the knee-joint. Her knee, while walking up the stairs or attempting any form of exercise, would give way, throwing her to the ground, and would become locked in partial flexion. Following this the knee would become painful and swollen. In addition she experienced pain over the internal aspect of the knee in the region of the anterior attachment of the internal meniscus. She also noticed in this location a small body, which, with displacement, permitted complete extension. That knee was slightly larger than the corresponding right. The muscles above the knee-joint were slightly atrophic. There was good motion both in flexion and extension; no lateral mobility. There was a definite point of tenderness over the anterior attachment of the internal meniscus, but no loose body could be palpated. There was a well-healed scar on the lateral aspect of the joint. X-ray examination was negative. An exploratory arthrotomy was advised.

Under general anæsthesia, a long parapatellar incision was made on the

inner side of the joint, displacing the patella outwardly. The synovial membrane of the joint appeared thickened and congested. The alar ligaments were slightly hypertrophied. The internal meniscus was found detached at its anterior extremity in a bifid manner. On the under surface of the internal femoral condyle there was a small erosion of the cartilage which was covered by granulation tissue and around which the cartilage was vascularized. The anterior portion of the internal meniscus was removed and the joint closed in layers with fine chromic gut. The knee was encased in a tight circular bandage. The patient's post-operative course was uneventful. Active motion was instituted one week after operation. An effusion into the knee-joint subsided without the aid of aspiration. She walked with the aid of a cane ten days after operation. She was discharged well two weeks after operation. Since that time the patient has had complete return of function. The symptoms have completely disappeared; she uses her knee freely, partakes of normal exercise and has had no return of her former trouble.

STATED MEETING HELD NOVEMBER 25, 1931

The President, Dr. John Douglas, in the Chair

CARCINOMA OF CÆCUM. PARTIAL ENTEROCOLECTOMY

Dr. Chas. L. Janssen presented a woman, fifty-two years old, who was admitted to the Presbyterian Hospital February 17, 1930. She had had vague abdominal pain for one year and recently cramp-like and more severe abdominal pains. There had been no nausea or vomiting. Three weeks prior to admission, she noticed blood in her stools. The bowels moved regularly but the consistency of the stools was unusually soft. There had been a marked and rapid loss of weight, loss of strength, dyspnœa and palpitation on exertion.

When admitted her temperature was 101.0°; pulse 110; respiration 22; blood-pressure 115/80. In the right lower quadrant there was a hard, movable mass. The liver was not palpable. There was no distention or visible peristalsis. The blood count was 3,890,000 red blood cells with 60 per cent. hæmoglobin, 10,750 white blood cells with 74 per cent. polymorphonuclears. Urine showed glucose but the blood sugar was .86. Blood urea was .23. X-ray of the colon showed a persistent obstruction in the right colon. The diagnosis was carcinoma of the right colon.

Operation.—After a week of preparation, the patient was operated on under spinal anæsthesia. The abdomen was entered through a right transverse incision. There was a hard mass about 10 centimetres in diameter in the cæcum. The appendix was drawn into the tumor and showed signs suggestive of a subacute inflammatory process. However, the appearance of the mass was quite characteristic of a neoplasm. Several nodes were made out along the ileocolic vessels. The liver was apparently free of metastases. An ileocæcal resection was performed. The distal end was closed immediately by an over-and-over suture reënforced by a second row of seromuscular Lembert's suture. This was further protected by an omental pad. About 15 centimetres from the ileocæcal junction, the ileum was then cut transversely with the cautery between two Kocher's clamps. When the tumor and its main lymphatic drainage area had been removed, the posterior peritoneum was repaired.

The anastomosis between the ileum and transverse colon was made by the closed or so-called aseptic method. To accomplish this, a cone of the anterior wall of the transverse colon was grasped with Allis' clamps and a Kocher's clamp applied at the base of the cone. The protruding tissues were excised by cautery. The clamp on the closed end of the ileum was brought alongside the clamp closing the opening in the transverse colon. Two posterior rows of seromuscular suture were taken and after bringing the clamps in close contact, one anterior row taken so that the clamps were entirely buried except at one point. After removing the clamps, the small remaining opening was closed. The second row was then completed. Patency of the anastomosis was obtained by digital palpation. A Witzel's ileostomy was performed and the tube brought out through a separate stab-wound incision through the left rectus. After anchoring the region of the anastomosis and colonic closure to the anterior peritoneal wall, the wound was closed with lateral drainage by a cigarette drain. The patient stood the procedure well and was transfused afterwards.

Pathological examination of the specimen showed a large, fungating, cauliflower tumor of the cæcum. The appendix was invaginated in the tumor at its base and showed signs of acute inflammation.

The microscopic section showed a well-differentiated adeno-carcinoma of the cæcum with some invasion of the muscular wall but no extension beyond the subserous tissue. Mitotic figures were fairly frequent. The lymph-nodes did not show evidence of metastases.

The convalescence was uneventful. The ileostomy tube was left in place for two weeks and the wound through which it came out closed promptly after its removal. There was a trivial infection in one point of the cœliotomy wound. The patient was discharged in good condition one month after the operation. X-rays taken since discharge showed an anastomosis functioning well.

This patient was presented to call attention to what is thought to be a very satisfactory technic of anastomosis on the colon. Although similar technics have been described and used by several surgeons for the last fifteen years, the impression is that it has not yet obtained the recognition it deserves.

Dr. Allen O. Whipple said that the method used by Doctor Janssen is one that has been used at the Presbyterian Hospital for a number of years. The speaker had first seen it used by Doctor Blake sixteen or seventeen years ago; it impressed him as being feasible. The results have been so excellent that a number of surgeons have used it since. Four weeks ago Doctor Whipple used it in a similar case and the convalescence was smooth and uncomplicated. In connection with anastomosis of the large intestine, if a method of this sort can be used it has some advantages. In regard to the clamps, the Kocher blades have to be very slender so they will not take up too much room when turned over, and the same principle applies to the handles, so they will not interfere when they are rotated. The aseptic method has advantages and disadvantages, but in the upper part of the colon where the presence of a diaphragm makes little difference this technic has distinct advantages.

Dr. Hugh Auchincloss said that whenever the question of this form of anastomosis comes up there is criticism because of possible obstruction. He

first saw this method done in 1914, and has used it in several cases since that time. It can be used in end-to-end as well as end-to-side anastomosis. He had just seen a patient in whom there had been a carcinoma of the large intestine just below the sigmoid, in the upper rectum. This type of anastomosis was done on her in 1918. The sigmoid and upper rectum were resected. A small perforation had caused two loops of small intestine to become adherent to it. Clamps were placed on the sigmoid and upper rectum and an end-to-end anastomosis done in the non-contaminating fashion described by Doctor Janssen. One hundred and fifty-two months after operation the patient weighed 132 pounds and seems perfectly well. In another case of advanced carcinoma of the descending colon an abscess had formed in the left iliac fossa. At operation, twenty months ago, resection of the carcinoma at the junction of the sigmoid and descending colon was performed with the clamp method—no mucosal suture being done. A film taken a few days ago showed a smooth sigmoid.

One should not deny the possibility of diaphragm formation, for that it may occur has been amply demonstrated. The amount of necrosis and the duration of sloughing, not to mention individual susceptibility to the formation of scar tissue and degree of peritoneal investment, are factors. Of course, where the fæces are fluid, as in ileocolostomies, obstruction is less likely. Cases of long standing with satisfactory function by means of this noncontaminating method are capable of being demonstrated.

Dr. Edwin Beer said that in connection with the formation of a diaphragm at the point of anastomosis, whether due to the œdema of the stoma or to the non-sutured free end of the intestine, he believes that this can be fairly well controlled by using interrupted stitches. The use of a continuous running stitch was more liable to pursestring the bowel and in that way predisposes to obstruction or diminution of the stoma. As far as the question of aseptic anastomosis is concerned, there is no doubt that all such procedures are infinitely superior to the old-fashioned way of anastomosing, as they lead to much less contamination of the operative field. On the other hand, it is very evident that even at best the operation is not absolutely aseptic, as, even with the electric cautery, in cutting through between clamps one has to traverse the contaminated intestinal lumen. This may be avoided by using a very broad crushing clamp two to three times the width of the Payr clamps.

Doctor Janssen, in closing the discussion, said that although continuous sutures were used, the stitches should be taken very close together. Excessive traction on the sutures should be avoided so as not to cause a pursestring action. As regarded asepsis, it was only by tradition that this procedure was called aseptic, but in comparison with other methods it is a very great improvement. The main thing is that there is no perforating stitch. With regard to marked diaphragm, with great care it is possible to avoid this.

FAMILIAL POLYPOSIS OF COLON WITH CARCINOMA OF RECTUM AND SIGMOID. ABDOMINO-PERINEAL PROCTO-SIGMOIDECTOMY

Dr. Charles L. Janssen presented two patients, brothers, both of whom had multiple polyposis of the colon.

The first case was a twenty-eight-year-old man who, when seen for the first time in July, 1930, was complaining of hemorrhoids of seven years' duration. He had been told, however, seven years ago that he had polyps of the rectum. The symptoms being mild at that time, he did not pay much attention to this diagnosis. Since three years, after a period of increasing constipation, he developed attacks of mild diarrhœa and occasionally noticed

Fig. 1.—Male, aged twenty-eight, No. 8 of pedigree. Polyposis of rectum and colon. Carcinoma of rectosigmoid with metastases.

red blood in his stools. Two months before admission, he observed mucus in the stools. Otherwise, there were no gastro-intestinal symptoms. There had been no loss of weight. Proctoscopic examination showed a large number of polyps of varying sizes, shapes and nature of attachment. The proctoscopic tube could not be passed beyond the recto-sigmoid junction where a large cluster of polyps was seen. A specimen of one of the polyps showed adenomatous changes but no malignancy. X-ray examination of the colon revealed round areas of diminished density which were thought to be consistent with colonic polyposis. It failed to show any definite sign of malignancy.

Operation.—Under spinal anæsthesia, a cœliotomy revealed numerous

masses in the rectum and sigmoid. One of them was large and hard and had a very large satellite adenopathy. The liver was free of metastases.

An abdomino-perineal procto-sigmoidectomy was done with a permanent colostomy.

The specimen, which was 40 centimetres after fixation, showed innumerable polyps of various sizes in the rectum and sigmoid with an adenocarcinoma of the sigmoid. The lymph-nodes in the vicinity of the growth showed metastases. There was also a good-sized vein with a mass of tumor cells in the lumen. The section of the carcinoma showed infrequent mitotic figures and a great deal of mucous production. Several polyps examined showed only benign glandular hyperplasia.

The patient was discharged forty-one days after operation. He was in good condition and his perineal wound was healing rapidly. He has enjoyed good health

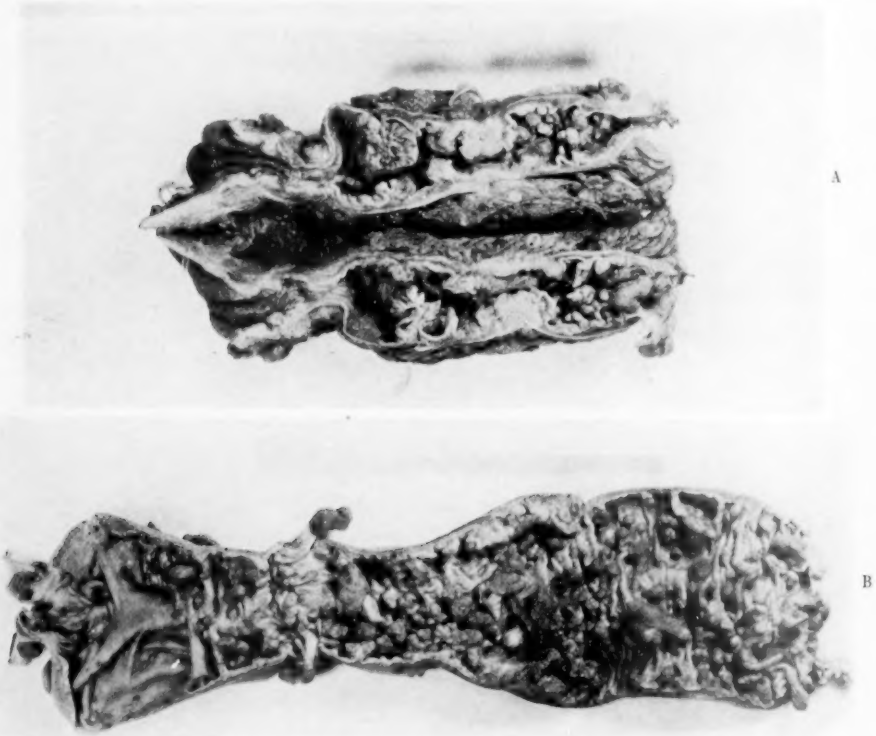

FIG. 2.—Male, aged forty-five. No. 5 of pedigree. Polyposis of rectum and colon. Multiple carcinomata with metastases. A—Distal part of specimen. B—Proximal part of specimen.

since the operation. His colostomy that had been functioning well until six weeks ago gave him at that time some trouble. The opening had become obviously too small to allow free bowel action. Therefore, a plastic was done which proved successful. The patient has gained 24 pounds since the operation and is back at his normal weight. The remaining colon still contains several polyps. Several were removed through the colostomy opening. The advisability of another partial colectomy is worth considering.

A second case was then presented who was the brother of the previous patient. This man, forty-three years old, complained of diarrhœa for one year. There was no mucus nor blood in the stools. He had had occasional griping pains in the rectum. There was a loss of about 7 pounds in weight in the last six months.

Proctoscopic examination showed numerous polyps of the rectum. About 3 centimetres from the anus there was a mass very suggestive of a carcinoma and at 10 centimetres there was a characteristic malignant tumor encircling the lumen of the rectum. Here also biopsy did not show any positive malignant changes. X-ray of the colon showed almost complete obstruction at the recto-sigmoidal junction with an irregularity in the outline. When another barium enema was given after the introduction of a catheter above the strictured area, the colon was outlined and showed multiple areas of lighter density suggestive of polyps.

At operation on January 23, 1931, the recto-sigmoid by palpation showed numerous masses movable in the lumen, presumably polyps, and also at least two areas where the consistency of the rectal walls was very suggestive of

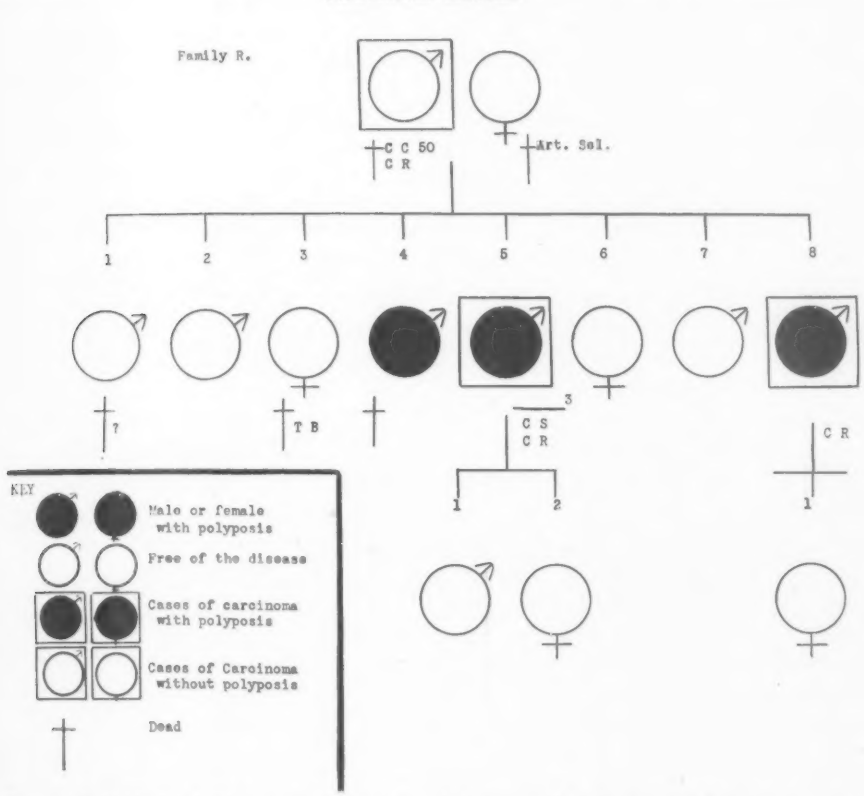

FIG. 3.—Individuals of third generation not recorded were said to be symptom-free but were not examined by the writer. Symbols as in Dukes' paper, The Cancer Review, vol. v, No. 4, 1930.

carcinoma. There were numerous hard nodes in the pelvic mesocolon. The aortic nodes were not palpable. The liver was apparently free of metastases. An abdomino-perineal procto-sigmoidectomy was done with a terminal left colostomy. The specimen showed innumerable polyps—four carcinomatous—in the rectum and sigmoid. The nodes showed extensive metastases. Some of them had evidence of calcification and one of ossification. This probably antedated the development of the carcinomata. The tumors showed mitoses in extraordinarily great numbers. One of the adenomas was of the villous type.

This patient also had a rapid and smooth convalescence. He was dis-

charged on the twenty-ninth day with the abdominal wound healed, the colostomy in good condition and the perineal wound healing nicely. He has been in good health since the operation. He has gained 14 pounds. He still has polyps in the remaining parts of the colon.

These two cases of polyposis of the colon with carcinoma, in brothers, unusual as they were, are especially interesting in the light of the family history. The father died at the age of fifty. It was learned that a colostomy had been performed on him by Dr. Arpad Gerster in January, 1906. The diagnosis was carcinoma of the rectum and splenic flexure. Although the evidence of underlying polyposis was not obtained, the fact that he had two carcinomata of the large gut makes this hypothesis very likely. The mother died of arteriosclerosis. There were eight children. The eldest one died of an unknown cause. The second, a man, has been examined and found free of any disease. A sister died at twenty-four years of tuberculosis (pulmonary). The fourth, a boy, died at ?? years. He had been operated on in August, 1925, by Dr. John Linder, of Brooklyn. The diagnosis was multiple papillomata of the colon. The fifth child is the second of the brothers presented. The sixth and seventh children are alive, were examined and found free of polyposis. The eighth is the first patient presented. The children of these two patients were proctoscoped and no evidence of disease found. Since presentation of these two cases, another member of the family has been examined and found to have polyposis of the colon. He is twenty-three years old, a son of patient No. 4 of the second generation who also was suffering with polyposis.

Although rare, these cases of familial polyposis have been reported occasionally.

BLEEDING DUODENAL ULCER. PARTIAL DUODENO-PYLORECTOMY. POSTERIOR GASTROJEJUNOSTOMY, APPENDICOSTOMY, ENTEROENTEROSTOMY

Doctor Janssen presented a twenty-year-old girl who was admitted to the Medical wards of the Presbyterian Hospital October 20, 1930. Nine days previous to admission, she suddenly felt very dizzy and weak. After resting for about ten minutes, however, she recovered enough to continue about her work. The next day she developed a diarrhœa and noticed that her stools were tarry. The following days, although she was able to work, she continued to feel weak and had several fainting spells. On one occasion, she vomited but she did not remember if the vomitus contained coffee-ground-like material. She became so weak that she could not stand erect. For a period of one year she had had occasional dull non-radiating epigastric pain occurring two to three hours after meals.

On the day of admission she vomited twice and the vomitus was also guaiac positive. Her Wassermann was negative. The urine examination was negative. She received an immediate transfusion of 600 cubic centimetres of unmodified blood. During the next days, she was given nothing by mouth. Then on the fourth day, she was started on the Sippy diet. But on account of the persistence of symptoms, her fluid intake was stopped completely again and she was given fluid by the parenteral route. In spite of this, she failed to show any improvement. Two transfusions were ineffective. She showed progressive weakness, her temperature rose progressively to 103.4° and her pulse rate to 130. The stools were still guaiac positive.

By the twelfth day of conservative treatment the picture was very alarming. She still had tarry stools, ran a high temperature, had a pulse rate of 130, her blood count was 1,520,000 with hæmoglobin 35 per cent. and her blood-pressure was 95/25. The opinion was that there was an ulcer of the posterior wall of the duodenum with bleeding from a rather large branch of the pancreatico-duodenal artery.

Operation.—Avertin, gas and oxygen anæsthesia. A transfusion was given at the onset of the surgical procedure and one at the end of the procedure. The abdominal cavity was entered through a right upper rectus incision. The small and large intestines were loaded with tarry material. As the accumulation of blood in the intestine was held to be responsible for the pyrexia, an appendicostomy was performed through a right lower quadrant stab wound. The pyloric region and the duodenum were explored by doing an axial duodeno-pylorotomy. The ulcer was located in the posterior wall of the descending portion of the duodenum. The crater was about 2 centimetres in diameter and the floor of the ulcer made of the head of the pancreas. A small blood clot was seen at one point on the bottom of the ulcer but no brisk oozing was observed. It was then decided to do a duodeno-pylorectomy. After ligating the vascular pedicles, the duodenum was cut transversely in front of the ulcer but it was soon found that the rather low location of the lesion would not allow an easy closure of the duodenal stump as the posterior duodenal wall had been destroyed by the ulcer and dissection below the lower level of the lesion was deemed unsafe. Therefore, a rather unusual type of closure was performed by separating the serosa and muscularis from the mucosa of the anterior wall. The mucosa was sutured to the head of the pancreas by interrupted chromic suture and a second row of suture obtained by suturing the serosa and muscularis on top of this. Then a piece of omentum was fastened on top by interrupted chromic gut stitches. A pylorectomy was then done and a short loop Pólya operation made to reëstablish the continuity of the gastro-intestinal tract. The patient stood this procedure well. It was believed that the one transfusion made this possible. During the following days, she was given large amounts of fluids by the intravenous route and also through the appendicostomy. She had a constant gastric drainage for four days. It was discontinued when it yielded decreasing amounts of gastric content. The temperature and pulse rate came down to normal on the sixth day. The colonic flushing through the appendicostomy was discontinued on the eighth day because the returns were clear.

The patient was apparently doing very well when she started vomiting on the eleventh day after operation. In spite of a reduced intake after operation, the emesis increased to 900 cubic centimetres a day, the temperature rose slightly and the pulse rate went up to 120. She was X-rayed and it was found that the greater curvature of the stomach reached the brim of the pelvis in the erect posture and that no barium passed through the stoma.

It was then decided to reoperate. *Operation.*—The afferent loop was found slightly distended and the efferent loop collapsed. Under spinal anæsthesia, an enteroenterostomy was done between the afferent and efferent loops. Following this procedure, convalescence proceeded satisfactorily except for an intramural abscess at the sight of the appendicostomy. This was drained. Finally, as the appendicostomy was still open, an appendicectomy was performed. The blood count rose progressively to normal without the need of any transfusion.

The patient has been followed at regular intervals and was put on an ulcer

régime. She had been completely symptom-free and her weight, which was 82 pounds at the onset of convalescence, went up to 138 pounds.

The speaker presented this case because he believed it to be an unusual example of failure of conservative treatment that made an operative procedure imperative. As simple gastroenterostomy in similar cases usually gives unsatisfactory results, this more radical procedure was performed. Appendicostomy is suggested as a useful adjunct to the treatment. It is felt that the duodenal closure used will find its indication in occasional cases. The enteroenterostomy if done at the initial operation might have avoided the post-operative high ileus.

Dr. Chas. Gordon Heyd said that the interesting portion in the treatment of this case was the enteroenterostomy. He recently had operated on a man for bleeding ulcer and after doing a simple uncomplicated gastroenterostomy, the patient was remarkably well for five days, and then began to vomit large quantities of greenish-black material, as much as 3,000 cubic centimetres in twenty-four hours. After forty-eight hours of this condition he was reoperated and an enteroenterostomy performed. The second operation did not benefit the patient as the vomiting continued and three days after the second operation a jejunostomy was performed. In a communication to the Philadelphia Academy of Surgery in May, 1931, Dr. Frederick A. Bothe reported three very interesting cases representing the same mechanism as in Doctor Janssen's case and in Doctor Heyd's case. In Doctor Janssen's case his enteroenterostomy functioned perfectly but in Doctor Heyd's case it was unavailing. The interesting condition in Doctor Heyd's patient was an acute inflammatory reaction of the exit or distal loop of the gastroenterostomy, whereby the entering or proximal loop of the gastroenterostomy emptied all of the duodenal material into the stomach, but no egress was possible. It seemed to Doctor Heyd that this must be, while not an infrequent condition, still not a rare one, and that some of the cases in which it was theoretically assumed that a spur was present probably had this mechanism as a basis for disturbance.

Dr. Richard Lewisohn thought it was impossible to make a general statement in regard to the treatment of acute bleeding ulcers. Every case required individual treatment. He believed that most surgeons wait too long for operative interference. Prolonged medical treatment of bleeding ulcers has a considerable mortality. It is generally conceded that operation at the time of a profuse hæmorrhage is a dangerous procedure. An effort should be made to tide the patient over the acute stage. If bleeding persists, however, surgery is strictly indicated.

Dr. Hugh Auchinloss said that some years ago he had operated on two cases of this kind within a year and both died. On the Medical Side they had bled white and been sustained only by transfusions. In both cases he did a gastroenterostomy. In the first case he tried to exclude the pylorus by a heavy, silk, subperitoneal purse-string ligature. This case continued to bleed. In the second case he believed he should have done a pylorectomy.

In spite of the precarious condition of the patient he thinks it probably would have been successful. At all events, it would have been logical.

Duodenal ulcers can be classified in many ways. Ulcers associated with penetration of the coats may well be considered as, first, those threatening diffuse peritonitis; and, second, those threatening hæmorrhage. Those threatening diffuse peritonitis are on the anterior wall. Those that perforate the posterior wall are the ones that bleed. Operations for posterior-wall perforations are more difficult than those on the anterior wall. Pylorectomy is the best way to stop the bleeding. It is something of an operation, however, and naturally one hesitates to do it. Nevertheless, one possesses, in transfusions, a better weapon than is available for many other types of complications, and more pylorectomies should probably be done when ulcers bleed than are done. When they are bad enough to have to be operated on, they are not likely to stop when only a palliative type of operation is done, and the base of the ulcer is usually formed by an open pancreatico-duodenalis vessel, artery or vein.

Dr. Edwin Beer said that the problem of operating for an acute hæmorrhage from the alimentary tract is complicated by the fact that in many cases one has no idea whether the bleeding comes from an ulcer or not. If preoperatively one is relatively sure from X-ray studies and history that the patient has an ulcer, repeated massive hæmorrhage surely demands operative control if possible, as there is no doubt that the patients who are not operated upon may bleed to death. In view of the fact that the operation is by no means free from mortality, it is evident that an exploratory for massive hæmorrhage without a positive diagnosis may be more threatening to the patient's life than medical, conservative treatment. Many cases of massive hæmorrhage from the alimentary tract have been seen without any evidence in the history that the patient was bleeding from an ulcer. The patients have usually recovered, and have never had any gastro-intestinal symptoms. In this group of cases, without a definite diagnosis, an exploratory operation would probably be more often a risk to the patient than a benefit.

Doctor Janssen, in closing the discussion, said that the rationale of the appendicostomy was that in such a case it might have been difficult to get promptly a normal bowel movement, so the opening was made to relieve the colon of the large amount of blood that had accumulated. Six litres of saline were used every day through the appendicostomy while a small tube was introduced into the rectum. When the return was clear the appendicostomy tube was removed. The temperature came down on the sixth day although the patient had previously been running a temperature as high as 103.4°.

THE CURE OF LARGE VARICOSE ULCERS BY EXCISION AND SKIN GRAFT

Dr. Grant P. Pennoyer presented two women to illustrate an operation for the cure of very large varicose ulcers of long standing, at the Peter Bent Brigham Hospital in Boston.

The operation consists of excising the entire area of the ulcer and the underlying scar tissue and deep fascia followed by immediate skin graft. The deep fascia and subcutaneous tissue in the cases will be found to be quite avascular and very much thickened. It is excised completely, leaving a thin layer of areolar tissue over the underlying muscle, or if it is over the tibia, leaving a thin layer of periosteum on the tibia. When this plane of cleavage under the deep fascia is found it can be followed by blunt dissection. The only bleeding of any consequence is usually from one or two thick-walled varicosed veins running into the ulcer region. The excision should be done out to relatively normal tissue, one-quarter to one-half inch from the edge of the ulcer. When this excision is complete there is a large excavation in the leg with the muscles or periosteum in the bottom of the wound. This is covered with Thiersch grafts taken from the thigh. The various grafts are placed so as to overlap each other and not leave any tissue uncovered by graft. Perforated rubber tissue is then placed over the grafts, on top of this a dressing, and then a rubber sponge which is held firmly in place with adhesive straps which are not disturbed for six days. This sponge is an important part in the technic as it furnishes just the right amount of pressure on the grafts to hold them firmly in place and it also absorbs the wound discharge.

The secret of the success of this operation, according to Doctor Homans, is the establishment of a new blood and lymph supply from the deeper tissues to the grafted skin area. The excision of the thickened deep fascia permits a fresh source of nutrition from the deeper circulation.

These two cases were selected on account of the very long duration and the extraordinary size of the ulcers. Neither patient has diabetes or syphilis. The first patient had an enormous ulceration which was of thirteen years' duration. It involved over half the circumference of the lower leg and was six inches in length. She was operated upon February 25 of this year. It can be seen that the area is well healed and has a nice normal soft skin. She has subsequently developed another small ulceration but the grafted area has normal nutrition and blood supply.

The second patient had also a very large ulceration of eight years' duration. She was operated upon April 5, 1929, by Dr. Howard Patterson and has remained well ever since.

Dr. Fenwick Beekman expressed particular interest in these cases because it had been his experience that in these old ulcers in which granulations have gone on to cicatricial tissue the only cure is to excise this tissue and use skin grafts. He had presented a case of a woman who had an ulcer over the malleolus which healed when she remained in bed but recurred when she was up and about again. He had excised the ulcer, moved in a triangular flap from the dorsum of the foot, and skin grafted the area from which he had removed the flap. There was no recurrence following this procedure. These are important types of cases but because they are so common, little attention has been paid to them and they have been left in the hands of the juniors on the hospital staffs.

Dr. Henry W. Cave said that he had had the opportunity of watching two or three of these cases of Doctor Pennoyer's on the wards of Roosevelt Hospital and it was impressive to see the skin heal so nicely over the

part that has been excised. So many of them recur with only bandaging and rest in bed that he considered this a feasible aid and the correct procedure in certain extensive chronic ulcer cases.

TRAUMATIC AMPUTATION OF THE THIGH COMPLICATED BY BOTH TETANUS AND GAS GANGRENE

Doctor Pennoyer presented a woman, twenty-three years of age, who was admitted to Roosevelt Hospital, February 16, 1929, immediately after an automobile accident. She had sustained a compound comminuted fracture of the left femur at the junction of the middle and lower thirds of the shaft with such extensive destruction of the soft parts and avulsion of the skin that there was little, if any, circulation below the site of injury. The muscles and fat were ground in dirt which came from the bridle path in Central Park.

The patient was in severe shock. The first treatment was directed toward this condition. She reacted well, and in two hours the systolic blood-pressure had risen from almost nothing to 110. She had already been given the usual prophylactic dose of 1,500 units of tetanus antitoxin. She was taken to the operating rooms, and under ether anæsthesia the wound was carefully cleansed and débrided of all dirt and devitalized tissue. The skin and subcutaneous tissue had been torn loose well up toward the groin anteriorly, and posteriorly from the mid thigh down below the popliteal space. The structures in the popliteal space were exposed as if they had been dissected out. The popliteal artery was intact but it did not pulsate. It was evidently thrombosed by the trauma. The femur fragments were held in exact position by a steel plate. Numerous Carrel-Dakin tubes were placed so as to irrigate the wound thoroughly, and the skin was only partially drawn over the denuded areas. A posterior splint was used for immobilization.

The general condition improved during the next twenty-four hours, but gangrene started in the toes. During the next twenty-four hours this gangrene spread with astonishing rapidity up to the knee. The whole lower leg was dark brown and was infiltrated with gas bubbles. Gas appeared in the wound, and the skin flaps took on a bronze hue. Smears of the copious wound discharge showed *Bacillus welchii*, with numerous other pyogenic organisms. The patient's temperature rose to 105° F., and the pulse rate to 140. Under nitrous-oxide anæsthesia a guillotine amputation was done at the mid thigh, leaving the wound wide open. The original wound was full of gas and gangrenous muscle tissue. The amputation was done just high enough to avoid most of this. Numerous Dakin tubes were placed in the open cleavage planes between the muscles and underneath the skin flaps.

The patient improved after this operation, and there was never any extension of the gangrene except in the skin flaps, though typical *Bacillus welchii* organisms were found in the wound discharge more than two months later.

February 23, the seventh day after admission and four days after the amputation, the amputation stump began to twitch occasionally in clonic fashion like a localized convulsion. These seizures lasted from five to thirty minutes and were extremely painful and distressing to the patient. Tetanus was considered but as a prophylactic dose of antitoxin had been given it was considered improbable and a dose of only 3,000 more units of antitoxin was given at this time. During the next two days these local convulsive seizures of the muscles became much worse. They would stop for a short time, and then the slightest movement or noise would start the process again. The

patient developed a severe headache, but there were no other meningeal symptoms.

On the tenth day after admission, Doctor Winslow reported tetanus bacilli in pus taken from the wound, establishing the diagnosis of tetanus. At once an injection of 20,000 units of antitoxin was given intravenously and 15,000 intraspinally. Some improvement in the symptoms was apparent the next day, and a dose of 20,000 units more was given intravenously. The following day, the twelfth, a dose of 20,000 units was given intramuscularly, making a total of 79,500 units given up to this point, which was thought would be sufficient. Four days later, improvement ceased, and there was a definite remission. An injection of 20,000 more units was given intramuscularly. This seemed sufficient for six days, when the colonic contractions of the stump muscles, which had about disappeared, returned. An injection of 15,000 units was made near the site of the anterior femoral nerve. This region was selected because the anterior muscles supplied by this nerve seemed to be the only ones involved in the convulsive seizures, and the pockets of pus from which the bacilli were still recovered lay anterior to the femur and in the adductor canal. Immediate relief of symptoms followed this injection, and subsequent experience seems definitely to prove that the antitoxin acted much more quickly when injected in the region of the nerve along which absorption of the toxin was taking place.

One week later the seizures again returned, and an injection of 6,000 units was made. Meanwhile the wound was cleaning up very satisfactorily, though tetanus and gas bacilli were constantly found in the deeper pockets. This recurrence of symptoms about a week after the last dose of antitoxin, continued till April 18, about two months after the onset of active tetanus symptoms. A total dosage of 130,000 units of antitoxin was administered in this interval. Tetanus bacilli and *Bacilli welchii* were found in the wound up to April 10, about two months after injury.

The patient never had any evidence of a serum reaction or serum sickness. Apparently there was a constant production of tetanus toxin in this patient and as soon as the injected antitoxin was neutralized or excreted, symptoms returned.

A minor plastic operation and traction by weights on the skin helped considerably to heal the large granulating area. An osteomyelitis of the lower end of the femur complicated the situation. She left the hospital in good condition, May 18, three months and two days after admission. A sinus remained until a sequestrum was extruded and the wound was entirely healed by July. She is now in good health and is walking well on an artificial limb.

This case is reported to illustrate the following facts:

(1) A combination of extensive gas gangrene and tetanus, even in a very large wound, is not necessarily fatal.

(2) The prophylactic dose of 1,500 units of tetanus antitoxin followed in seven days by 3,000 units does not always prevent tetanus.

(3) Tetanus bacilli under certain conditions can produce recurrent symptoms after the disease has apparently been arrested by antitoxin.

Dr. Alfred Stillman remarked that regarding the symptom of twitching of muscles in the wound site, he had seen a similar case while in service in France in a patient with bad thigh wounds in which the débridement left both sciatic nerves exposed. He believed at this time the twitchings were due to the exposure of the nerves to irritation of dressings, *etc.*, and did

not recognize tetanus. The patient died that night of tetanus four days after injury and in spite of a prophylactic injection of antitetanic serum. This was vividly recalled and so Doctor Pennoyer was urged to use serum as quickly as possible and in large dosage and then to take a smear.

The method of injecting the serum is of interest. The intravenous route is the best; the intramuscular and subcutaneous are not so good as absorption is so slow. Doctor Pennoyer gave it intraspinally but Doctor Stillman doubted the value of that. Only the toxin at the site of formation and in the blood can be neutralized by the antitoxin.

One must remember in doing secondary operative procedures, even if the patient has no continuous signs of tetanus, to give antitetanic serum again as the old disease may be lighted up.

DR. HENRY H. M. LYLE said just such cases as Doctor Pennoyer describes were not infrequent in the late war. To guard against recurrent attacks of tetanus the French issued orders that all the wounded requiring reoperation or manipulative treatment that might stir up a latent tetanus were to be given protective doses of antitoxin serum and the doses were to be repeated for each procedure.

BILATERAL NEPHROLITHIASIS

DOCTOR PENNOYER presented a man, fifty-three years of age, who was admitted to Roosevelt Hospital, Second Surgical Division, August 8, 1928, complaining of pain in both kidney and bladder regions, milky urine, fever and prostration.

The symptoms had started three months previously but had become much worse the last three weeks.

The essential findings on examination was an enlarged tender left kidney, urine full of pus, blood count 13,120, 74 per cent. polymorphonuclears, temperature 103°, pulse 110, and obviously a very sick man. X-rays of the kidney regions showed very large calculi on both sides. First dye test only 10 per cent. excretion in two hours. The blood chemistry on admission showed a blood urea nitrogen, 46.0; uric acid, 7.0; sugar, .105; creatinin, 2.0. Cystoscopical examination showed that only pus was coming from the left side and very cloudy urine from the right. He continued to run a very septic fever and a generally downhill course. His blood urea nitrogen rose in ten days to 61.90, his creatinin to 3.5, uric acid to 8.0. The temperature rose to 105° at times. It was decided that in view of his downward course and of the presence of the large pyonephrosis of the left side, with no secretion of urine from this side, that this kidney might be the chief factor in his sepsis and that it was justifiable to attempt a nephrectomy. The left kidney was accordingly removed under spinal anæsthesia on August 27, 1928, eighteen days after admission to the hospital. The kidney was a large, multilocular bag of pus containing nine calculi up to five centimetres in diameter. During removal the sac was broken and a large amount of very foul-smelling pus escaped. Large rubber drains were inserted. He made a remarkable recovery, temperature dropped to reach normal in six days and his general condition immediately improved. On discharge October 17, six weeks after operation, his blood chemistry was normal and dye output 53 per cent. in two hours. He has been seen frequently at recall clinic since. He has gained eighty pounds in weight and is doing his regular work with no complaints.

His blood chemistry taken last week was normal and his urine shows a faint trace of albumin and a small amount of pus.

The case was shown to illustrate the difficulty of estimating the function of one kidney in the presence of sepsis resulting from the other kidney, and also to show the great recuperative power of the kidney when the sepsis is relieved. Incidentally, it presents an example of a man with a very large renal calculus at the present time with no resulting symptoms. In his judgment it would be unwise to attempt to remove this calculus in spite of the low-grade infection which we know it is causing.

Dr. Edwin Beer advised caution in doing a nephrectomy in one step in pyonephroses associated with blood urea retention and inadequate function of the second kidney. Routine one-step nephrectomy in these cases for a long time has been recognized as a dangerous procedure, with a much higher mortality than a two-step procedure; primary drainage followed by nephrectomy when kidney function on the second side has become normal, or almost normal. As far as operating upon the second kidney and removing the stones, Doctor Beer advised such a procedure to control the infection.

ANGIOMA OF THE THUMB

Dr. John Douglas presented a man, sixty years of age, who had noticed a bluish swelling on the ulnar aspect of his right thumb seven or eight years previously. This gradually increased in size and was diagnosed as an angioma. It caused him very little trouble until shortly over a year ago, when it increased in size more rapidly and extended further up the dorsum of his hand. At this time he had an operation which consisted of removal of part of the angiomatous tissue and an enlarged artery and vein extending up on the back of his hand to the level of the wrist-joint. The patient states that at this time the vein pulsated. Following the operation there was a further increase in size of the angioma and the patient noticed an increasing blueness on the palmar aspect of the end of the thumb. An attempt was made to reduce the size of the angiomatous areas by injection treatment, using small amounts of glucose and quinine hydrochloride and urethane. This did diminish the swelling in the area in which it was used but in the past two or three weeks the angiomatous area on the radial side of the thumb had greatly increased in size and about four weeks ago an area about one centimetre in diameter broke down, forming an exceedingly painful ulcer which it has been impossible to get to heal.

Doctor Douglas presented this case for advice as to what should be the further treatment. The patient is a dentist by occupation, the lesion, which is on his right thumb, is becoming worse and the X-ray of the bones in the thumb seems to indicate that the angiomatous process has invaded the first phalanx. So far, treatment has been unavailing and the possibility of ultimate amputation must be considered.

Dr. Chas. Gordon Heyd said that he recently had a case almost identical with this one. The patient had an angioma of the right thumb occupying about two-thirds of the terminal phalanx and equally distributed on the dorsal and palmar surfaces. On compressing the thumb the blood could be squeezed out almost like water out of a sponge, and upon releasing the pressure the blood would immediately fill out the angiomatous tissue. By means of a

Cameron coagulation needle a series of linear cauterizations was carried out extending from the tip of the thumb well up and under and beyond the base of the nail. The same procedure was carried out on the palmar surface. The result was complete obliteration, in the course of about six weeks, of the entire angiomatous tissue. In regard to the X-ray pictures of Doctor Douglas' case Doctor Heyd stated that it was not unusual in conditions of hypervascularization to have changes, either in the form of increased periosteal proliferation or even to the point of some bone atrophy.

Dr. Russel H. Patterson said that he first saw this patient some six months ago, at which time examination showed the right thumb to be larger than normal. There was a scar on the radial side of the thumb about the middle of the first metacarpal bone. An attempt had been made about a year ago by another surgeon to remove several of the larger vessels on that side of the thumb. The distal phalanx of the thumb consisted of bluish discolored skin underneath which lay masses of dilated blood-vessels which could be compressed until the skin came in contact with the bone. X-rays showed the bone to be very porous. It seemed the blood-vessels had absorbed great channels through his bony substance.

A very competent dermatologist was consulted. He advised against the use of radium, X-ray treatment, or any kind of electrical treatment.

During the last few years Doctor Patterson has injected quinine and urethane hydrochloride into hemangiomata with uniform good results. Therefore it was thought that such treatment might be carried out on this case. Accordingly at intervals such injections were given on the ulna side about the base of the thumb. A thickening and obliteration of certain veins at this point did take place. Due to the very poor condition of the skin on the distal phalanx it was not thought advisable to inject this area. The patient has continued at his work, as a dentist, he has continued playing golf and on several occasions has received fairly deep contusions of the thumb. As a result of one of these contusions necrosis of a small area occurred on the end of the thumb, moderate low-grade inflammation ensued. The thumb has not had careful regular daily surgical dressings.

It is believed that absolute rest and careful dressings would still cure the thumb, and it is highly unlikely that the patient will coöperate 100 per cent. In such treatment the coagulation of the vessels in the end of the thumb would certainly be advisable providing the skin would not be broken down by such treatment.

Dr. Henry H. M. Lyle said the first thing to do was to get the pathological diagnosis of the section removed for examination. Regarding the healing of the ulcer, rest, protection and support of the local circulation were necessary. The latter would be improved by wearing of a suitable perforated rubber glove, the perforations to take care of the discharge from the ulcer. In looking at the X-ray film Doctor Lyle believed that the bone findings are not similar to those of a varicose ulcer because there is no direct

evidence of inflammatory changes in the bone, there is no periosteitis, nor does he believe that it is an osteoporosis from pressure because there are no signs of osteoporosis, but there are signs of similar circulatory condition in the bone itself.

If this is a congenital arteriovenous aneurism or one beginning in an angioma, the prognosis is bad; if it is a simple angioma the prognosis is much better.

Dr. Robert H. Kennedy said that if this is an angioma a great deal can be done with the coagulating current. It is possible to make an angioma disappear completely in a few sittings. He thought the diagnosis ought to be established by pathological study.

Doctor Pennoyer said he hated to be pessimistic but believed the case would come to amputation. He had presented a similar case before the Surgical Section of the Academy last year, which had originally been operated upon by Doctor Peck in 1919. He had had several operations, electrocoagulation, injection treatment, and other procedures without effecting a cure. He was finally amputated in 1929. The pathology report by Dr. James Ewing was malignant angioma.

THE FISSURES OF THE LUNGS

Dr. Frank B. Berry read a paper with the above title.

Dr. Allen O. Whipple said that Doctor Berry's paper illustrated the value of a study combining experimental method with clinical problems. If more work of this type were done, using anatomical study, which has somewhat fallen into disuse as a result of the shift to physiology and chemistry, more helpful data would result. The appearance of these shadows impresses one with the quandary one would be in in trying to localize them in the lung unless one had given careful study to this subject. The difficulties to be encountered in this work are understandable. It was impossible to get stereoscopical views, but they would have been interesting. The point Doctor Whipple wished particularly to comment on was Doctor Berry's use of anatomical studies in clearing up some of these difficult clinical problems. There is a large field for investigation to be done on these lines of anatomical and embryological studies.

Dr. J. B. Amberson (by invitation) said that the interlobar fissures in the healthy subject can often be visualized in the X-ray film; the right transverse fissure shows as a thin hair line running across the chest somewhere between the second and fourth ribs in the postero-anterior view, the oblique fissures being shown only in the lateral view. At Bellevue a knowledge of the anatomy of the fissures has been of particular value in cases where there is a question of diagnosis between lung abscess and encapsulated empyæma. Sampson and Brown, in 1922, thought they detected localized inter-

lobar pneumothorax in many cases of pulmonary tuberculosis, but more recent studies indicate that most of these annular shadows represent tuberculous cavities within the lung. The anomalous fissure is that which divides the azygus lobe from the upper lobe on the right. This is caused by an aberrant course of the azygus vein as it turns forward to enter the vena cava. In one thousand children X-rayed at the Bellevue Yorkville Health Demonstration, this anomaly was found in seven. It is of importance as a possible point of localization of interlobar fissures. Slides were shown illustrating some of the points mentioned.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY

STATED MEETING HELD OCTOBER 5, 1931

The Vice-President, Dr. John Speese, in the Chair

Calvin M. Smyth, Jr., M.D., Recorder

SUBPHRENIC ABSCESS FOLLOWING CHOLECYSTECTOMY

Dr. Hubley R. Owen reported the case of a woman forty-six years of age, admitted to the Woman's College Hospital November 13, 1930, giving a history typical of calculous cholecystitis. The last attack of biliary colic occurred ten days prior to admission. A cigarette drain was inserted and the patient was returned to the ward in good condition. The second day after operation the temperature rose to 102°, and again on the fourth, eighth and eleventh post-operative days the temperature was elevated. During this time the pulse did not show any corresponding acceleration and during the intervening days the temperature fell to normal. On the eighteenth post-operative day she developed a typical steeple chart, the temperature running from 98° in the morning to 102° or more at night.

An X-ray taken twenty-five days after operation showed marked elevation of the right diaphragm with a small amount of fluid in the right costophrenic angle. Right diaphragm was limited in its respiratory excursion but showed some movement. These signs suggested the presence of a liver abscess. The day following this X-ray report, twenty-six days after the cholecystectomy, an incision was made below and parallel to the right costal margin. There were adhesions between the chest wall and dome of the liver and on separating these adhesions an abscess containing 50 cubic centimetres of sero-purulent material was evacuated between the dome of the liver and the diaphragm. The temperature fell to normal two days after operation and she was discharged twenty days after operation. Bacteriologic examination of the fluid evacuated showed staphylococcus aureus in pure culture.

The speaker remarked that subphrenic abscess as a complication of cholecystectomy, especially interval cholecystectomy, is apparently rare. Two cases are mentioned by DaCosta.[1] Whipple in a series of thirty-two subphrenic abscesses occurring at the Presbyterian Hospital, New York, reported one case following interval cholecystectomy. This patient was not drained. The abscess was opened on the sixth post-operative day. A second case followed interval cholecystectomy which was drained. A third case was that of an interval cholecystectomy with drainage which was complicated by "a brisk subhepatic hæmorrhage." An X-ray showed a high right diaphragm, but owing to the fact there was no elevation of temperature or other signs of infection the case was not operated upon and the symptoms cleared up in about ten days. Whipple thought this case undoubtedly was a collection of fluid which absorbed without suppuration. Gatewood in reporting a group of forty-one subphrenic abscesses occurring at the Presbyterian Hospital in

Chicago reported five cases following suppurative cholecystitis, but mentions but one case as occurring eight days after interval cholecystectomy. Grove in reporting 1,000 cases studied by Lance, states that 13 per cent. were due to lesions of the gall-bladder and liver, but does not enumerate those which followed cholecystectomy. Subphrenic abscess following diseases of the biliary tract such as suppurative cholecystitis and cholangitis is stated as occurring in 5 per cent. (Gatewood[2]), 13 per cent. (Grove[3]) and 16 per cent. (Whipple[4]). Graham[5] believes that subphrenic abscess is not an uncommon complication of non-calculous infective cholangitis.

The case now reported is the only one occurring in a series of 114 consecutive cholecystectomies performed on the author's service at the Woman's College and the Philadelphia General Hospitals. Subphrenic abscess following cholecystectomy is probably due to the result by gravity or to extension of the infection through the lymphatics. As in Whipple's case, the speaker believes that his case, although drained at the original operation, occurred as a result of a subhepatic hæmorrhage with secondary infection, probably from the stump of the cystic duct although this duct was severed with a cautery.

Doctor Owen remarked that at the present time he seldom drains cases of interval cholecystectomy. Drainage is employed, first, when there is slight controllable ooze; secondly, in cases of gross infection of the biliary tract; thirdly, in the presence of dilated common duct; and, of course, in the presence of common-duct stone. In view of the subsequent complication of the case reported, had he not drained he would have been inclined to criticize himself, but it is apparent that drainage alone does not prevent subphrenic abscess. A dry wound is imperative, as a persistent ooze of blood or bile is undoubtedly a causative factor. Every precaution should be taken to prevent any leakage from infected foci, such as infection of the cystic duct. When drainage is employed the speaker thinks that it should not be removed too early.

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[1] Modern Surgery, p. 953.
[2] American Journal of Surgery, p. 2, January, 1926.
[3] American Journal of Medical Sciences, p. 398, 1930.
[4] Journal Medical Association of Georgia, p. 69, 1928.
[5] Diseases of the Gall-bladder, p. 216, 1928.

DUODENAL ULCER. UNUSUAL RECURRENCES

DR. WILLIAM J. RYAN reported the case history of a man aged sixty who was first operated upon by Dr. George P. Muller, assisted by the reporter, in December, 1915, for perforation of a duodenal ulcer. The perforation was closed by purse-string suture and a posterior gastroenterostomy made. He made a complete and uneventful recovery and was perfectly well until July, 1922, when the symptoms of ulcer returned. He was then again operated upon by Doctor Ryan, who found an ulcer at the site of the original perforation. The gastroenterostomy was functioning perfectly. The ulcer was destroyed by cautery and the defect closed in the usual manner. Recovery was again uneventful. This time the patient remained symptom-free until July, 1930.

On the evening of July 29, 1930, he was seized with agonizing pain in the upper abdomen. The pain grew worse in spite of hypodermic injections of morphine. He vomited once, having eaten a full meal four hours before the onset of the pain. He was transported sixty miles by train and admitted to the hospital approximately twelve hours after the onset of the attack.

Examination revealed board-like rigidity of the abdomen with no localized tenderness and with marked increase in the area of liver dullness. The white-blood count was 15,600 per cubic millimetre. Flat-plate and fluoroscopic X-ray examination showed the presence of free gas under the left diaphragm. A provisional diagnosis of perforated gastric ulcer was made.

At operation, under spinal anæsthesia, a perforation of the jejunum was found just below the old gastroenterostomy. A large amount of free fluid was present in the peritoneal cavity. The perforation was closed by purse-string suture and drainage established through a stab wound below the umbilicus. Recovery was uneventful except for a slight wound infection and the patient was discharged on the twenty-second post-operative day.

Doctor Ryan placed this case on record because of the rather unusual history, namely, recurrence of the original ulcer seven years after an operation for perforation and the development and subsequent perforation of a jejunal ulcer eight years after the recurrence and fifteen years after the performance of a gastroenterostomy which was functioning perfectly.

OSTEOCHONDRITIS DESICCANS OF THE FEMUR

Dr. Eldridge L. Eliason reported the case of a man twenty-three years of age, admitted to the University of Pennsylvania Hospital, February 26, 1930, with the chief complaint of pain in the left knee on outward rotation. This complaint had persisted from its origin three months before without injury or obvious cause. He stated furthermore that his knee seemed to lock of late. The knee presented no restriction of movement but was swollen and tender over its medial aspect. Rotation produced pain. An X-ray examination showed osteochondritis to be present. Arthrotomy under spinal anæsthesia was accordingly performed and the following pathology was found: A disc of bone of a dead-white color was detached from the cartilaginous surface of the lower end of the femur and suspended under a hinge formed by its attachment to the crucial ligaments posteriorly. The cavity from which it had come was partly filled with fibrous tissue. This portion of the bone was freed and removed and the joint cavity closed with interrupted sutures of chromic catgut. A posterior plaster-of-Paris splint was applied to temporarily immobilize the joint. He was discharged nine days later after an uneventful recovery. Microscopic examination of the specimen removed was reported as "Osteochondritis desiccans." Culture of the joint fluid proved negative for bacterial growth. The subsequent course has been normal in so far as his knee is concerned.

MULTIPLE FOREIGN BODIES IN THE GASTRO-INTESTINAL TRACT

Dr. V. W. Murray Wright, by invitation, reported the case of a woman admitted to the Surgical Service of Dr. E. L. Eliason, at the Philadelphia General Hospital, May 3, 1931. She complained of pain in her lower right abdominal quadrant, nausea and vomiting. As she was mentally defective her history was unreliable. She was a white girl of twenty years of age. Her lower right abdomen was rigid and tender to palpation. The greatest point of tenderness was lateral to the colon and immediately above the iliac crest.

Peristalsis was increased. The pelvic examination revealed some tenderness in the right fornix. Her leucocytes were 9,200 per cubic millimetre, and her temperature, pulse and respirations were 99.3°-90-20 respectively.

Under spinal anæsthesia a right iliac gridiron incision was made with the expectation of finding an acute retrocæcal appendicitis. The appendix, however, was found to be normal. Immediately above the lateral to the base of the appendix some exudate and adherent omentum were noticed. Elevation of the latter showed the sharpened end of a lead pencil to be protruding through the wall of the cæcum. This was surrounded with a purse-string suture and the pencil was withdrawn without contamination. During her convalescence she passed four short lead pencils by bowel.

X-ray examination after operation revealed multiple parallel lines in the stomach which were taken to be lead pencils though the outlines were vague. Later attempts by bronchoscopic service to remove the lead pencils from the

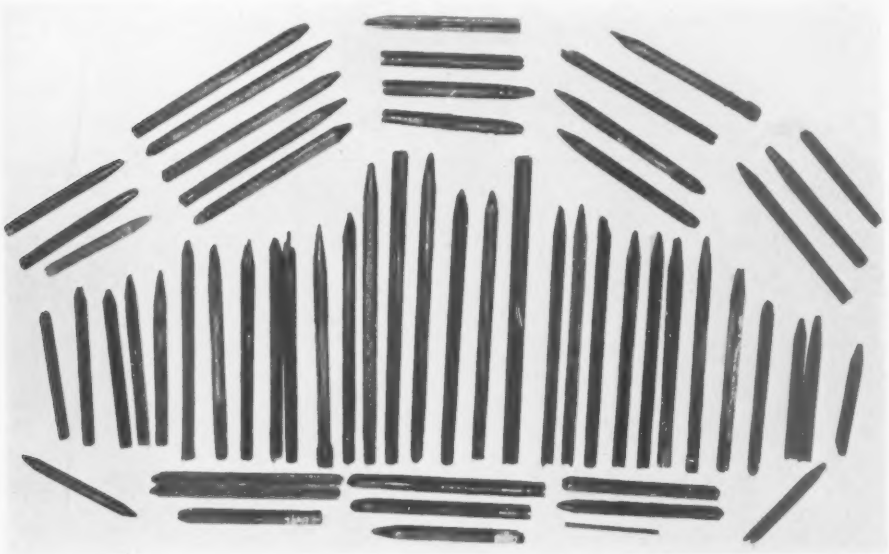

FIG. 1.—Lead pencil pieces removed from the stomach.

stomach proved unsuccessful due to the fact that the weak ends of the forceps slid off the end of the pencils which were imbedded in the gastric mucosa. Subsequently a gastrotomy was performed by Doctor Eliason and forty lead pencils were removed from the stomach. (Fig. 1.) These were mostly imbedded between the rugæ. Convalescence was uneventful. A recent follow-up call to the Byberry Insane Hospital where she is confined because of dementia præcox reveals that she is well and has not swallowed any more lead pencils to their knowledge.

DR. HUBLEY R. OWEN said that the size of some of the foreign bodies swallowed by patients is astounding. At the Philadelphia General Hospital several years ago he removed a teaspoon swallowed by an insane patient and last year removed a glass test tube. Both of these recovered. Even when foreign bodies perforate through the stomach or intestinal tract they seldom cause general peritonitis but usually such perforation is followed by a local

abscess. The speaker operated upon one case and removed a foreign body from the centre of an appendiceal abscess.

Dr. V. W. Murray Wright recalled a young man who was admitted to the Philadelphia General Hospital with a diagnosis of peritonitis resulting from the perforation of a hollow viscus. A "scout" X-ray plate of his abdomen revealed air under his diaphragm and two hazy parallel lines in his upper left abdomen which resembled a tongue depressor. The abdomen was opened directly over this area and a walled-off abscess the size of a grapefruit was found. Evacuation of the abscess revealed the end of a *tongue-depressor-swab* protruding through the jejunal wall. The foreign body was removed and several drainage tubes were inserted. Several days later the patient seized a nurse's thermometer and after biting it in two, swallowed the pieces. The course of the two fragments was followed by X-ray until several days later when they presented themselves at the drainage opening and were readily removed. He had at one time a large comminuted fracture of his skull which was trephined and had never been normal mentally since the accident.

PERFORATION OF MECKEL'S DIVERTICULUM BY A FISH BONE

Dr. Adolph A. Walkling reported the case of a boy eight years of age, admitted May 5, 1930, to Surgical Division B of Jefferson Hospital with pain in the right lower quadrant and a temperature of 100°, pulse of 90 and respirations of 24. Two days before admission he complained to his mother of pain in the abdomen and was given a saline cathartic which was effective. He vomited on the following day and the pain definitely localized in the right lower quadrant. He became restless, his pain was very severe and the vomiting continued until his admission. He had eaten fish three days before the onset of symptoms. There was no history of previous gastro-intestinal disturbance. The abdomen showed slight distention and marked tenderness and rigidity in the right lower quadrant. Peristalsis was heard, no masses were palpable. The white-blood count was 15,000 per cubic millimetre.

On opening the peritoneal cavity some turbid fluid escaped. The exploring finger found a mass of small bowel adherent to the posterior peritoneum in the right iliac fossa. The mass was isolated with packs and opened: a small amount of pus escaped. The finger then came in contact with a sharp pointed object which felt like a pin. The section of ileum containing this object was brought out of the abdomen. It was found to be a diverticulum of the ileum, the tip of which was gangrenous and from this gangrenous area there protruded a small bone. (Fig. 2.) The diverticulum, which was 26 centimetres proximal to the cæcum, and its adjacent portion of the ileum were resected. The appendix was also removed. One small cigarette drain was carried down to the infected area and the abdomen then closed about the drain. The diverticulum measured 3.5 centimetres by .5 centimetre. The bone proved to be the rib of a fish.

Recovery was uneventful and the patient was discharged on the fourteenth post-operative day.

The reporter remarked that perforation of a Meckel's diverticulum by a fish bone has been reported only once before.[1] This patient was operated upon in 1899. Perforation of the intestines by swallowed fish bones is ap-

parently rare, but one wonders why this should be so. Fish bones are commonly swallowed but case reports on perforation are not commonly seen. Probably reasons for infrequent perforation are that either these objects are caught at some point in the pharynx or œsophagus or are surrounded by fæcal matter and are as a result harmless. The large intestine is the most frequent site of perforation, the cause of which is probably the sacculations, the thin wall and the churning movements. The small intestines and stomach are rarely perforated, although there has been reported a death from gastric hæmorrhage because of perforation of the posterior wall of the stomach by a fish bone.

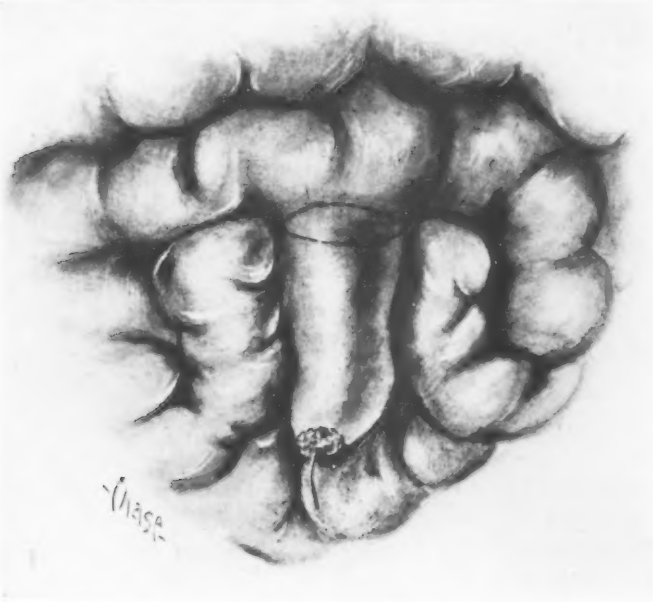

FIG. 2.—Showing diverticulum with fish bone protruding.

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FRACTURES OF THE PELVIS

DR. WILLIAM R. GILMOUR read a paper with the above title for which see page 161.

TRAUMATIC RUPTURE OF THE JEJUNUM

DR. ELDRIDGE L. ELIASON presented a thirteen-year-old boy, who was admitted to Surgical Service C at the University of Pennsylvania Hospital May 30, 1930. He stated that he had fallen flat on his abdomen on a flat cement yard seven hours before. He further stated that three-quarters of an hour afterwards he vomited and that he developed pain in the abdomen radiating to the left shoulder. This pain became worse and was followed by chilliness and vomiting.

The temperature, pulse, respirations, on admission were 98.8°—100—36. Physical examination revealed a high right diaphragm with obliteration of

liver dullness anteriorly. His abdomen was tense, tympanitic, flat, rigid and tender. No peristalsis was visible or audible. A flat X-ray plate of the abdomen while standing up revealed considerable air beneath the right diaphragm, which was high and limited in its movements. Some fluid was noted in the right costophrenic angle. A diagnosis of ruptured intestine was made and immediate laparotomy under ether anæsthesia performed. Fluid, particles of food, and an undigested strawberry were found beneath the transverse colon. These were found to have exuded from a spiral split in the jejunal wall beginning just below the ligament of Treitz and extending downward for three to four inches. This was oversewed, a jejunostomy performed below the point of rupture and the tube was carried through a stab wound in the left flank. Drainage consisted of two cigarette drains to the jejunum and a split tube suprapubically. The abdomen was closed after thorough washing of the abdominal cavity with warm normal saline solution.

Post-operatively, a Jutte tube was placed in his stomach. The boy's convalescence was perfectly smooth for five or six days. Then when liquids were given *per oram* it became stormy due to regurgitation of food caused probably by the jejunostomy tube occluding the jejunum. As soon as the tube was removed he convalesced rapidly. An X-ray examination one week after operation showed some hesitation of the barium in the region of the jejunum. Following his discharge from the hospital the boy remained normal except for occasional slight abdominal pain until six months later when he was re-admitted after being hit in the stomach by another boy. He was confined to the hospital for two days and then returned home. An X-ray examination at that time revealed slight stasis of the jejunum.

Dr. Damon B. Pfeiffer said the ordinary history in rupture of the jejunum is a sharp blow. He recalled an exactly similar case in which the patient was thrown off a circular saw and as Doctor Eliason said, it seems a rather common way for these injuries to be sustained. Another case in which he played an inglorious part at the Presbyterian Hospital several years ago, was that of a very large fat woman who had fallen on the flat of her back as she was going up steps. The history was clear and definite. Her daughter said she fell over backwards on account of pain in the abdomen. She did not look as though she was bleeding and falling on the flat of her back he thought she probably had an injury to the back which referred pain to the abdominal area; she was therefore not operated upon at once, but later developed all the classical signs of intestinal perforation.

STATED MEETING HELD NOVEMBER 2, 1931

The President, Dr. George P. Muller, in the Chair

Calvin M. Smyth, Jr., M.D., Recorder

HÆMOPERITONEUM—PROBABLE SPLENIC ORIGIN

Dr. Edward B. Hodge and (by invitation) Dr. Robert S. Alston, presented an Italian man, aged forty-nine, who was admitted to the Germantown Hospital December 15, 1929, complaining of severe abdominal pain. He stated he had retired as usual the night before and was awakened about 5 A.M. by an agonizing pain in the upper abdomen. It was not a sharp pain but a terrible ache getting worse and worse until his abdomen became very

hard; he vomited once; an injection of morphine caused sleep for a few hours; on awaking he still had great pain and his abdomen was even harder. Now he sought hospital treatment; when admitted to the ward he seemed in great pain, was apprehensive, restless and shocked, but perfectly conscious and rational. The striking thing about him was the board-like rigidity of the abdomen. Percussion over the abdomen was tympanitic with some movable dullness in the flanks. There was no especial area of tenderness. The abdomen was so hard nothing could be felt through it. Peristalsis slightly diminished was heard throughout the abdomen. His chest was clear, his heart compensating, his blood-pressure was 80/50. He had no complaints as to his previous health and denied any blows to his abdomen. He was operated upon in this hospital three months ago when a gangrenous appendix was removed without any complications. He then had a normal convalescence, was discharged in good condition, and remained well until this attack. His appetite was good. His bowels were regular and he had a normal movement the day before. His past medical history was negative for both malaria and typhoid fever.

Laboratory Findings.—Red blood-cells, 2,900,000; white blood-cells, 12,800; hæmoglobin, 52 per cent. Differential count, normal. Temperature, pulse, respirations, 97–96–30. Urine negative.

When the abdomen was opened, through a high right rectus incision, there was a gush of bright blood and small clots floated into the wound. When the flow of blood was controlled, exploration of the peritoneal cavity revealed no bleeding point; the spleen was about four times its normal size, very soft and congested but not grossly bleeding. There were two denuded areas on its under surface near the hilum. These were not bleeding and were thought to be caused by handling. Most of the clots in the abdomen were congregated in the upper left quadrant but removing them caused no fresh hæmorrhage. The whole abdominal cavity was then packed with gauze to absorb all the free blood and these were allowed to remain for a time. Then a second careful search was made for a bleeding point. This proved unavailing and it was decided to close the abdomen and treat the patient expectantly.

After a somewhat stormy convalescence he was discharged on the sixteenth day with a blood count of 4,730,000 red blood-cells; 12,100 white blood-cells; 75 per cent. hæmoglobin, and a normal differential count. During his stay in the hospital the following laboratory tests were made: *Cell morphology*, variance in size and shape of red blood-cells, otherwise negative. *Parasites*, negative for malaria and typhoid on several occasions. *Platlet count*, 320,000 per cubic millimetre. *Coagulation time*, four minutes and ten seconds. *Bleeding time*, less than one minute. *Fragility of red cells*, hæmolysis begins at 0.425 per cent., is complete at 0.35 per cent. *Vandenberg test*, direct method, negative direct reaction; indirect method, four units strength of bilirubin 2.0 milligrams per liter. *Widal*, negative.

At present, the spleen is markedly enlarged, reaching to the umbilicus. The blood count now shows red cells, 5,800,000; white cells, 10,700; hæmoglobin, 96 per cent., indicating the development of a polycythæmia. He feels perfectly well.

The speaker remarked that hæmoperitoneum from spontaneous rupture of diseased spleens, either in the course of an acute illness or at some time thereafter, is more often reported than spontaneous rupture of normal spleens. An article in the British Surgical Journal, in 1930, by H. Bailey on Spontaneous Rupture in the Normal Spleen cites only eleven cases to date.

The first was published in 1919. Of the eleven cases nine were males ranging from sixteen to fifty-three years of age and two were females aged twenty-seven and thirty-five respectively. All of these cases were treated by splenectomy and the microscopical reports showed in all cases examined normal splenic tissue. In four cases no tissue examination was made. In this series seven recovered and four died. There was no consistent site of rupture. T. S. Jackson reported a case at first thought to be spontaneous rupture in a fifteen-year-old girl who was seized while sitting in the theatre but later found that she had been forcibly thrown against a desk just four weeks before. Microscopically, the spleen was normal. The case was reported to show the long interval between the blow and the rupture.

Of spontaneous rupture in diseased spleens there is more written. Berger collected a series of 123 cases in 1927. Of these, ninety-nine were malarial. This picture is also common in parts of Italy, where malaria exists. Wohl reported another series of twenty-eight cases where rupture occurred spontaneously in the course of acute disease. Fourteen of these were in typhoid fever. There was also a series reported by Pyrah, Stansfield and Garland of three cases of ruptured splenic vein in disease where both the liver and spleen were enlarged. In 1853, Bowie reported in the Bombay Journal a case of spontaneous rupture in the course of common continued fever. This was a necropsy finding. In 1882, Calkins reported in the Michigan Journal a case of rupture thirteen years after acute malaria in which the spleen had remained large. This was another necropsy finding.

The reasons advanced for rupture in malarial and typhoid spleens are: (1) Softening of the spleen; (2) engorgement of the spleen; (3) blood forced between the splenic tissue and the peritoneal covering, and (4) perisplenic adhesions fixing a large, soft, engorged organ. All agreed the picture was the same in traumatic and spontaneous rupture except for the blow. Several points were stressed as aids in diagnosis, the development after a few hours of pain in the left shoulder and its persistence, and the fact that in gastro-intestinal ruptures there is rarely vomiting while in hæmoperitoneum there is commonly vomiting. The treatment advanced was splenectomy or suture, never tampon packing except as an emergency measure. In the case reported there was hæmoperitoneum of probably splenic origin with recovery without splenectomy or suture.

Dr. Calvin M. Smyth, Jr., said that in 1924 he and Dr. Damon B. Pfeiffer reported a number of cases of rupture of the spleen before this academy. These cases were all traumatic, but traumatic rupture and spontaneous rupture differ more in etiology than in symptomatology. In spite of the fact that the reporters had not been able to demonstrate a lesion in the spleen in this case, it is quite possible that a small tear was present in the splenic pulp. These tears are often very hard to locate, especially with the abdomen full of blood and the patient in bad condition. The interesting thing about this case is that in the course of two years there has been a

marked increase in the enlargement of the spleen without symptoms but with the apparent development of a polycythæmia. Pemberton has recently stated that enlarged spleens in the absence of definite etiology should be considered as instances of the splenomegaly of potential splenic anæmia and advised operation. It seemed to the speaker that this was such a case and he believed that this man should have his spleen removed before the development of further trouble.

SARCOMA OF THE UPPER END OF THE HUMERUS

Dr. Rutherford John presented a man, aged forty-two, who was first seen June 23, 1924, complaining of pain in the right shoulder for previous six months. Some years ago he had erysipelas in the right hand; typhoid fever in 1910; mild attack of pneumonia in 1917. General health otherwise has always been good, habits regular. Had Neisserian infection in 1910, lasting for a few weeks.

About six weeks after the pain started, a swelling in the region of the head of the right humerus was noticeable. No history of injury except that four or five years ago he was struck on the shoulder while boxing. He was a fairly well-nourished and well-developed adult male; general appearance of health and vigor. The right upper extremity showed swelling about the lateral surface of the head of the right humerus the size of a small lemon; there was slight local elevation of temperature, no tenderness, but pain in the shoulder and down the arm, worse at night. The shoulder joint was fixed in slight abduction. X-ray examination showed in the head of the humerus a cauliflower cystic-like appearance, the shaft down to its middle had a moth-eaten appearance with periosteal proliferation. At one place there seems to be new bone laid down on the shaft. The possibility of lues caused blood Wassermann to be made at this time, which was negative. The tumor steadily increased in size until October 6, 1924, when an X-ray showed "a huge swelling now present involving the outer upper portion of the humerus which is of the same density as the other soft parts. There has been more absorption of the upper portion of the shaft. The hazy areas extend well down the shaft, through its middle third. The periosteum has a distinctly fuzzy appearance. In the upper third there seem to be distinct perpendicular striations. A diagnosis of sarcoma was now made.

Deep X-ray therapy was started which relieved the patient's pain. His general health continued good, his shoulder-joint remaining stiff but with only twinges of pain on changes in the weather. Repeated X-rays showed the process extending downward along the shaft of the humerus, being most active in the middle third. Has been averaging one X-ray treatment per month. March 11, 1931, he was subjected to biopsy, in the course of which the bone was found to be so hard and sclerosed that a few chips were removed with a gouge and mallet with difficulty. The wound healed quickly by first intention. No diagnosis was made on the tissue removed, it being reported as unsatisfactory for examination.

From this time until June 17, 1931, the tumor in the upper third of the arm enlarged rapidly. It was lobulated, fairly firm, and not adherent to the skin. Along the line of the first incision the mass had softened, pointed and was near to rupture. At operation date, a large amount of fairly well encapsulated, lobulated, gray, friable material was removed from the soft parts, from which it was easily freed by blunt dissection, giving the impression of having grown from a deeper layer by pushing the muscle tissue apart. This

tumor was not adherent to the bone nor did it appear to arise from it. The bone itself was found as dense and hard as on the previous examination, Dr. C. Y. White's report on this tissue is as follows: "The bone specimen shows in two small areas infiltration of a doubtful sarcoma involvement; unable to make a better or more definite diagnosis. The soft tissue shows mixed cell sarcoma." Smear and culture negative. X-rays of all long bones and lungs failed to show evidence of metastasis.

In spite of the laboratory diagnosis of sarcoma no amputation was done. The patient's general condition was excellent; he had no pain. The X-ray showed involvement of the glenoid cavity of the scapula and of the outer end of the clavicle. An amputation would have meant a very serious shoulder-girdle amputation and Doctor John felt that if there were other involvement that it most certainly had occurred in these eight years. The patient was sent away for six weeks with no treatment. On September 21, 1931, he returned, having gained seven pounds and looking the picture of health. The operative line was slightly inflamed and the soft parts almost as large as before the removal of tissue in June, but the patient had no pain. After one deep X-ray therapy most of the mass in the soft parts disappeared. The inflammation about the incision has cleared up except for one small area at the centre of the incision, which is scabbed over. The patient is back at work and feels perfectly well.

Dr. Edward T. Crossan wondered whether this was a sarcoma or ever was a sarcoma. The microscopical slides suggest an epithelioma, and, clinically, it has acted like one. To assume this to be a sarcoma, to assume that the X-ray has made it disappear, to assume that the man has been alive for eight years, and that he has had a biopsy without growth in the scar, is almost too much to believe.

Dr. John said that he gave the diagnosis with a question mark for the very reasons that Doctor Crossan had brought out, microscopical slides were sent to two laboratories, also a specimen was sent to Baltimore and the diagnosis of sarcoma was made by all three; so there were three laboratory reports contrasting with the clinical picture as seen at this time.

SARCOMA DEVELOPING IN A RECENTLY FRACTURED NECK OF THE FEMUR

Dr. T. Turner Thomas reported the case of a woman, sixty-eight years of age, who, on December 25, 1929, fell, injuring her left hip. The following morning she was admitted to the Northeastern Hospital, where the X-ray disclosed an intertrochanteric fracture of the left femoral neck with the detachment of a separate large fragment carrying the lesser trochanter. The left lower extremity lay helpless in eversion and shortened.

December 26, under light ether anæsthesia, a Whitman abduction case was applied from the chest to the ankle. The patient suffered little or no pain or discomfort. She was taken home in her immobilizing apparatus two weeks after the accident. The after course continued uneventfully. The plaster case was removed at the end of seven weeks. After two more weeks she was permitted to sit out of bed for short periods daily and three weeks later was permitted to stand up with crutches and soon to take a few steps. At this time there was evidence of what was interpreted to be an excessive mass of callus in the fracture area. Even then she did not acknowledge

FIG. 1.—Intertrochanteric fracture of neck of femur. One day after accident.

FIG. 2.—Same case two days after accident and one day after reduction by Whitman abduction case.

FIG. 3.—Same case four months and two weeks after accident, showing evidence of sarcoma.

any pain except in certain positions of the limb. She probably had more than she complained of. During the following three or four weeks the patient was kept in bed with the hope that if it was callus it would slowly subside with rest. On the advice of her surgeon, Doctor Thomas, however, she returned to the hospital for X-rays of the mass and was admitted to the Philadelphia General Hospital May 5, 1929.

At no time did the mass feel like a well-defined encapsulated tumor. It seemed to be an ill-defined infiltration of the tissues about the fracture which could be felt as an irregular hard mass close to the skin. The patient at no time showed more weakness than might be expected in as thin a person with a fracture of the neck of the femur. The reporter visited her in the hospital on the day after admission and found her in about the same condition as when she left home. But a day or two later when she was taken to the X-ray department and numerous films were taken, she collapsed. She died May 9, 1931. At post-mortem widespread metastases to the lungs were found. The heads of the X-ray department of the University Hospital, after examination of the X-ray films taken at the Northeastern and Philadelphia General Hospitals, have diagnosed sarcoma, probably enchondrosarcoma. They incline to believe that it was present before the fracture and that this was, therefore, a pathological fracture. They agree that probably no röntgenologist would have diagnosed a pathological fracture at that time. Their evidence is a slight concentration of bone in one of the fragments near the fracture line. They also said that X-ray films of similar cases are very rare. At the Philadelphia General Hospital the autopsy diagnosis was osteogenic sarcoma of the left femur with metastasis to both lungs. The X-ray diagnosis of the lung condition was chronic ulcerative tuberculosis of both lungs.

FORWARD DISLOCATION OF THE KNEE

Dr. Frederick R. Robbins reported the case of a colored man, thirty-eight years of age, who was admitted to the Pennsylvania Hospital September 8, 1924, on account of an injury to his right knee. The right knee showed a large recession to the left and over the patellar region with a bulging in the popliteal space, where the condyles of the femur could be felt protruding and stretching the skin. Above the head of the tibia the patella was lying loosely and recessed well below the level of the anterior edge of the tibia. The foot was warm and dorsalis pedis and posterior tibial pulse could be palpated. An X-ray examination showed a forward dislocation of the right knee-joint with the remarkable features that there appeared to have been no avulsion of the spine of the tibia, nor any evidence that any bone had been detached at the attachment of the crucial ligaments to the femur.

Under gas-ether anæsthesia an immediate closed reduction was done. The right thigh was slightly flexed and supported on sand bags. Extension was applied to leg with very slight over-extension of leg on thigh, combined with pressure upward and backward on condyles of femur; pressure downward and forward on head of tibia with a simultaneous pull on the leg. The head of the tibia could be felt and heard to slide into place with a soft click. A posterior splint was applied.

On the third day after reduction another X-ray examination showed that the normal relation of the bones of the right knee had been established. On the fourth day there was slight swelling of the knee with fluctuation; ecchymosis extended from knee to hip on posterior surface of the thigh. The patient complained of pain in the knee and abdomen at night. The twelfth day after admission, the patient signed a release and walked home, with

partial aid of crutches. Two months later the patient was reached through the Social Service. He refused to come back to the hospital. At that time he was walking well, using a short cane. The fact that the patient had a positive Wassermann did not delay convalescence.

The speaker added that complete forward dislocation of the knee is rare. Reduction is easy, although a general anæsthetic is always advisable. The reduction should be done promptly, but if possible X-ray should be taken first. He advised a relatively short fixation on a splint, with early physiotherapy, heliotherapy and passive motion. Surprisingly good results are reported when the injury is extensive, and when function is reëstablished early.

In the last ten years, 63,248 patients were admitted to the Pennsylvania Hospital, of which number there was but one dislocation of the knee. In the last eight years, 76,983 patients were admitted to the Graduate Hospital of the University of Pennsylvania, with one incomplete lateral dislocation of the knee; and in the last four years, 13,230 patients were admitted to the Bryn Mawr Hospital, with one incomplete lateral dislocation of the knee. Each of these general hospitals has a large traumatic surgical service, where dislocations should be relatively frequent. Yet, in over 150,000 admissions, there was only one complete dislocation of the knee. Since the dislocation is produced by some severe type of violence, the condition of the vessels and nerves distal to the seat of the injury should always be determined. Forward, posterior, mesial, lateral, and rotary types have been distinguished, the term being used to describe the position of the leg with reference to the femur. In 1909, 270 cases of dislocation were reported; 114 being of the forward type. Several cases have been reported since.

Platt reports two cases: First, a twenty-year-old girl, who, while crossing a dark field, slipped, caught her left foot in a hole and fell over backward on the left side. The dislocation was reduced, posterior splint applied for ten days and plaster-of-Paris for five months. The result was complete ankylosis in full extension. The second was a man, forty-seven years of age, with forward dislocation, which was easily reduced. A plaster case was kept applied for four months. Eleven months later the knee was painless with 20° range of flexion, and abnormal lateral mobility. In the opinion of the speaker, these two patients were immobilized for too long a time. Ransohoff reports three dislocations of the knee in twenty-eight years at the Cincinnati Hospital. In a too rapid fall of a mine shaft elevator, five out of eighteen occupants sustained forward dislocation of the knee. All recovered and were soon at full-time work. Herring reports a similar accident of six miners in a shaft, three sustaining forward dislocation. In two of these cases amputation was necessary, due to gangrene following injury to the popliteal vessels. Stetter reports a case where a soldier, running down hill, suddenly straightened up to salute an officer, and at once collapsed with a posterior dislocation of the knee. Hardouin reports the necessity of twelve amputations in twenty-seven posterior dislocations, because of vessel injury. Open operation is occasionally necessary for reduction. Gilbert reports a case of forward dislocation which was reduced and patient insisted on leaving the hospital on the second day. He walked as well as ever without dis-

comfort, wearing an elastic bandage. He returned to work on the twentieth day.

TREATMENT OF FRACTURE OF THE NECK OF THE FEMUR

Dr. A. Bruce Gill read a paper with the above title.

Dr. George M. Dorrance remarked that the results of a second series of intracapsular fractures of the femur were not as satisfactory as his first series. Most of the patients were over sixty years of age. Recently the speaker examined a number of these patients who had union and was surprised that several of them had pain in the hip. He has had no experience with the Whitman reconstruction operation as it never seemed correct to him either from an anatomical or physiological standpoint. The arthrodesis seems to be a distinct advance in the treatment of some of these cases.

Dr. J. Torrance Rugh remarked that going back over his own experience he is forced to conclude that each case must be treated individually. He does not believe it possible to lay down any exact rules regarding ununited fractures of the hip. It is quite generally admitted that in the younger patients and up to sixty years of age the Whitman abduction method gives better results than any other procedure, and yet it is not a universal method of treatment. Any set rule is going to meet with disaster in case after case and one is forced to select the treatment according to the condition of the moment. One hears a great deal about absorption of the head and the neck and implicit reliance is placed on the X-rays for the determination of the degree. The speaker does not believe this reliance is constantly justified. He has, on several occasions, cut down upon a femoral head said to be almost entirely absorbed to find it quite hard and holding firmly a bone-graft placed in it through the femoral neck. He is a little more in favor of the bone-graft for fixation of cases of non-union and has obtained better results from this method than by any other line of treatment.

THE USE OF POTASSIUM IODIDE IN HYPERTHYROIDISM

Dr. Charles H. Frazier read a paper with the above title.

BRIEF COMMUNICATIONS

GANGRENE OF THE STOMACH*

CASE I.—*Gangrene of the Stomach.* The patient, a member of the Police Department of the city of New York, thirty-five years of age, was a man of exceptionally good habits and fine physique. He had never had any serious illness. On Sunday, November 3, his tour of duty permitted him to be home for his mid-day meal. For this meal his wife cooked a duck which was said to have come from a farm on Long Island. It was undrawn and the contents of the gizzard, together with all of the entrails, were still in the fowl when it was purchased. Subsequent inquiry failed to obtain any further information as to when the duck was killed, or how long it had been kept on ice. Poultry sold by this butcher came into his possession through cold-storage warehouses. The time allowed for dinner was short and the patient was hungry. He ate heartily of the duck, and in considerable haste, and then reported for duty. Two hours later, while on post, a sudden attack of diarrhœa occurred, and several times during the afternoon and evening he had similar profuse diarrhœal stools. The odor of his stools, as he described it, "being very much like something that had been dead for a long time."

Shortly after the diarrhœa began, vomiting also occurred and portions of the duck were regurgitated which had a most offensive odor and taste. No other members of the family were affected.

At ten o'clock in the evening nausea and vomiting began in a much more active form and lasted more or less continuously until five o'clock in the morning. The diarrhœa was also continuous and the stools were very offensive. He reported sick on Monday morning, November 4. I, the police surgeon of his precinct, first saw him professionally about two o'clock on the same day. His temperature at that time was 97.6°. An hour after I saw him, his family physician called and found the temperature to be 104.2°. At three o'clock in the afternoon, soon after this, he had a chill which was so severe that he shook the bed. This continued for about ten minutes and at four o'clock his temperature was 105°. He was in a condition of stupor by this time and could remember little, if anything, of the events of that day.

Tuesday, November 5, his temperature was normal in the morning, but a chill occurred about every four hours, sometimes of extreme violence. Each chill lasted from five to ten minutes. Chills continued during the week, but lessened in severity, although the four-hour intervals remained essentially the same. After each chill, the temperature rose to 103°, or even to 105°, and then within an hour fell to normal or nearly so.

Although far from well, circumstances compelled him to report for duty again on the morning of the 11th of November. During the day he had two chills at a two-hour interval. When seen by me in the afternoon the abdomen was soft, there was no rigidity on either side and no point of tenderness could be found, after a most careful examination. His diet was restricted to fluids only. He was seen again on the 15th of November and had had no chill since the 13th. No solid food had been taken during the previous forty-eight hours. He had taken, however, 1½ quarts of seltzer, mixed with orange juice, to relieve his excessive thirst. Asked for a swallow or two of water every two minutes and complained of a burning sensation in his throat, which was relieved somewhat by the passage of the cold drink. Nausea persisted. There was no point of local tenderness in the abdomen. Neither rectus muscle showed any rigidity. Temperature ranged from 99 to 100° and the patient's general condition appeared to be somewhat improved.

On the 16th of November, the condition of the patient was less favorable. Some tenderness developed in the right lower quadrant of the abdomen and there was slight

* Read before the Association of the Alumni of the Methodist Episcopal Hospital of Brooklyn, N. Y., January 22, 1931.

rigidity of the right rectus muscle. The exact diagnosis was still in doubt, but it was evident that hospital care was indicated, and on the morning of the 17th, he was admitted to the German Hospital of Brooklyn, in the service of Dr. James Peter Warbasse.

At the time of his admission, the symptoms just mentioned had become accentuated. There was a definite rigidity over the right side, the legs were drawn up and there was tenderness over the entire right lower quadrant. The leucocyte count showed 23,600 cells with 80 per cent. polymorphonuclears.

The pulse was 108, respiration 28, and temperature 102.2°. He was prepared for an immediate operation, taken to the operating room and operated upon at once by Doctor Warbasse. Upon opening the abdomen, through the usual right-curved incision, a large retroperitoneal abscess was discovered lying behind the descending colon. The posterior wall of the intestine formed a part of the abscess wall, but the exact point of infection could not be definitely determined. The abscess cavity was extensive in area, but had burrowed behind the peritoneum and did not produce a definite tumor mass which could be palpated, notwithstanding the fact that about one-half pint of pus escaped through the operation wound. The pus was pale blue in color and later, on the subsequent dressings, where the discharge had become exposed to the air for a short time, there was a very definite blue color to the discharge—quite characteristic of an infection caused by the Bacillus pyocyaneus. A second wound was made in the posterior aspect of the right flank and two drainage tubes were inserted, the one in the anterior wound, the other in the posterior one. The appendix was congested and discolored, but had not ruptured. The head of the cæcum and a portion of the posterior wall of the descending colon was in the same condition. Whether the actual point of infection came from the appendix, or through the lymphatic channels of the mesentery of either the small or the large intestine, could not be definitely determined.

The patient returned from the operating room in good condition. Vomiting continued, from time to time; the vomitus was a brown fluid. He complained of great thirst and of an area of soreness and of burning on the right side of the sternum and over the entire epigastric region.

The subsequent progress of the case was most unsatisfactory. On the 18th, the leucocyte count was reduced to 18,000 cells, the proportion of the polymorphonuclears remained as before. His temperature varied from 98.8° to 100.8°. Lavage was given from time to time. Feeding by the stomach was discontinued and nutrient enemata were substituted. These were not well retained at first, since hiccoughs soon developed in addition to his nausea and vomiting. A daily blood count was continued, and on the 21st there were 31,400 leucocyte cells reported, with 90 per cent. of polymorphonuclears. The hiccoughs became continuous, most of the time. After a day or two a mild delirium began. The drainage from the wound through both tubes continued, and the gauze, surrounding the area of the wound discharge, was surrounded by a halo of a light blue color, about one-half inch or more in width. The nausea, vomiting and hiccoughs continued and steadily grew worse. The wound, on the other hand, continued to drain well and the temperature steadily subsided. The nutrient enemata were well retained, and his bowels moved regularly once or twice a day, though sometimes the stools were involuntary. The blood count which was made daily showed no material change from that already noted.

On the 29th of November, he vomited about an ounce of dark red blood. Several times during the day, similar attacks of vomiting occurred of one to three ounces of dark red blood. During the afternoon of this day, he became steadily worse, and shortly after midnight, he died.

At autopsy, the following conditions were found, the notes of which I made myself:

The body shows a fair degree of nourishment, although there is a considerable loss of weight from that which existed at the beginning of his illness. There is a slight icterus but no œdema. The primary wound of operation, four inches in length and oblique in direction, exists in the right iliac region. The walls of the abscess cavity are of a deep black color, and look as if an active caustic had been used. A superficial gangrene

of all the surface was present. There is no pus in the abscess cavity and the drainage had been free and complete.

The lungs show a moderate degree of hypostatic congestion in the dependent portions

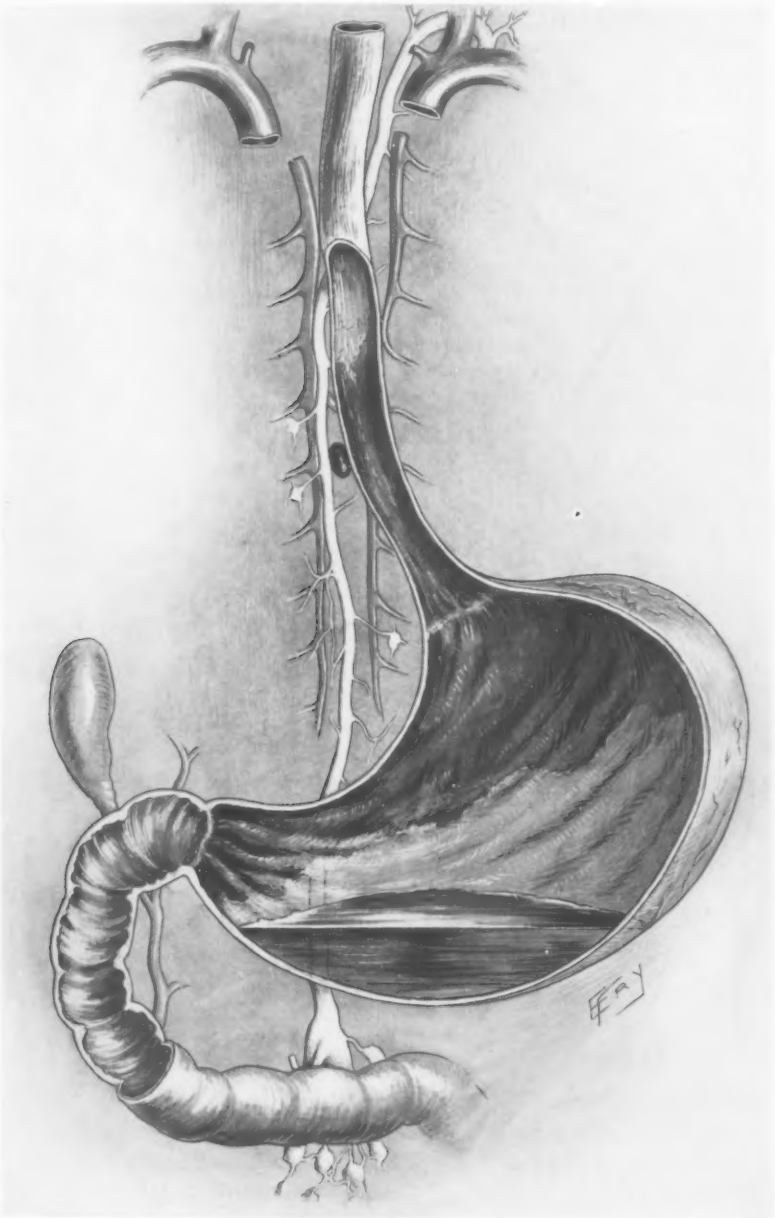


FIG. 1.—Sloughing of the entire mucous membrane of half of the œsophagus and all of the stomach. Death from capillary hæmorrhage.

of both sides. Both lungs are otherwise normal and show no evidence of pleurisy, pneumonia, or tuberculosis. The heart is entirely normal. The liver is somewhat enlarged and shows a considerable amount of fatty infiltration. It presents no abnormalities. The spleen is of normal size, of firm consistence, and of normal structure. The bladder is

slightly distended with urine. There is no lesion of the bladder walls. Both the urethra and ureters are normal. The kidneys are both swollen and show a moderate degree of congestion. The pelvis of each kidney is normal.

The stomach is moderately distended. Upon incision it is found to contain over a quart of a dark, almost black fluid, which upon careful examination is found to be composed of equal parts of venous and of partially digested blood. This has the same peculiarly offensive odor which characterized the wound discharges during life, and which must have occasioned the statement, so often made by the patient, that he was vomiting material which tasted and smelled exactly as if it came from the wound itself. Upon lifting the stomach from its position in the abdominal cavity, the slight effort used to raise it caused the stomach to tear off at the entrance of the œsophagus. Further examination shows that *the mucous membrane of the caudal half of the œsophagus and of the cephalic half of the stomach is black and completely gangrenous.* It has sloughed off from the muscular walls of the stomach in a number of places and from the capillaries of these denuded areas has occurred the hæmorrhage into the stomach which was the primary cause of death. The muscular walls of the stomach and of the œsophagus ectad of the gangrenous mucous membranes, are very friable and tear upon the slightest tension. The small and large intestines were normal.

After the removal of the intestines the abscess cavity was carefully dissected out. It was found to take its origin close to the right of the median line on the level of the second lumbar vertebra, but the receptaculum chyli from which it is supposed that the infection started could not be satisfactorily demonstrated.

The appendix also could not be positively identified. A small fragment dorsad of the cæcum and lying upon the ventral wall of the abscess cavity is all that is found to represent the probable remains of the appendix. This was entirely extra-peritoneal.

The thoracic duct is carefully followed from the diaphragm, cephalad, into the neck. In gross appearance it is not distended, nor does it show any evidence of direct suppurative inflammation. Between it and the œsophagus, contiguous to the gangrenous area in the œsophagus itself, is a small gland, one centimetre in length, which is quite black and necrotic in structure. Direct communication between the œsophagus and the gland, or between the gland and the thoracic duct, cannot be established, although minute channels of infection could easily have existed between them.

Cause of death.—Primary: Acute gangrene of the mucous membrane of the œsophagus and stomach, with resulting capillary hæmorrhage into the stomach.

Secondary causes.—Acute suppurative infection of the post-peritoneal tissues, arising primarily, either from the receptaculum chyli or from the appendix.

The micro-organism in each location is the same (Bacillus pyocyaneus). Gangrene resulted in each instance.

So far as I can ascertain, this case is unique. There is, therefore, no bibliography to be appended and no references to be cited. The nearest approach to any similar condition which I can find, was in the case of "Acute Suppurative Inflammation of the Thoracic Duct," reported by myself in 1907, published in the *New York State Journal of Medicine* in the same year, and later included in Osler's "Encyclopedia of Medicine." The Bacillus pyocyaneus was the active cause of the infection in each case, whereas in the case to which I have just referred, the infection travelled from the stomach or œsophagus to the thoracic duct and infected it. In the present case, the bacilli appeared to have started on a similar course, but the infection reached the post-peritoneal tissues only and also the submucous membrane of the stomach itself.

HENRY PELOUZE DE FOREST, M.D.,
New York, N. Y.

INSTRUMENT FOR SUBCUTANEOUS REMOVAL OF FASCIA LATA STRIPS FOR SUTURE PURPOSES

ALTHOUGH the use of long strips of fascia lata as a living suture has proved of great value in many operations for the repair of various kinds of herniæ and injuries to joints, a strong deterrent from such an operation, in

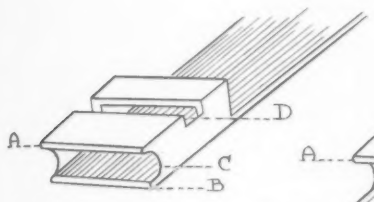


FIG. 1.

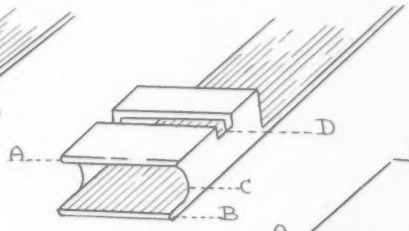


FIG. 2.

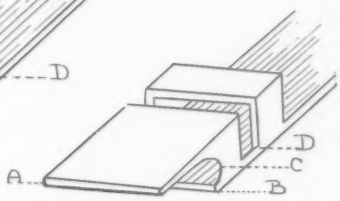


FIG. 3.

FIG. 1.—A—Blunt anterior edge of slot. B—Blunt posterior edge. C—Concave cutting edge on each side of slot. D—Groove cut through the top of slot to allow insertion of sharp-pointed knife in order to sever the distal end of fascia strip.

FIG. 2.—B—The lower blunt edge of the slot protrudes a millimetre and a half or two millimetres in order to separate the under surface of the fascia first and thus force the upper blunt edge to lie snugly against the outer surface of the fascia.

FIG. 3.—A—Modification showing the upper edge protruding instead of the lower. This may be an advantage in case the other types do not strip the fascia easily. D—Showing modification with the groove cut through the top and sides of the slot. The type shown in Fig. 1 protects the adnexa better.

the patient's point of view, is a long ugly scar extending the length of the thigh.

For the past six years we have thought that an instrument which would strip this fascia out subcutaneously would be a useful adjunct to our armamentarium. As no suitable case, in which to use this method, came under our care, we did not crystallize the idea into instrumental form until re-

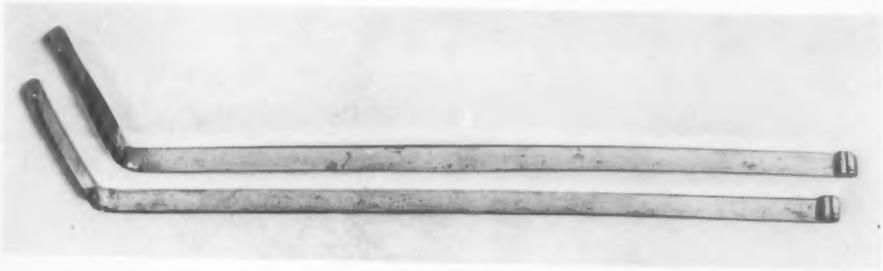


FIG. 4.—Photograph of instrument in experimental form.

cently. Our plan is to make a small incision over the upper portion of the iliotibial band of fascia lata and thread a piece of fascia in a small slot at one end of a narrow ribbon of spring steel. While the end of the piece of fascia which has been threaded in the slot is held taut, the slot is pushed toward the distal part of the iliotibial band. When a strip of fascia of sufficient length has been separated, a pointed knife can be inserted through the skin until it engages in a second slot which is just behind the cutting slot and perpendicular to it. This slot guides the knife point so that the fascial

strip can be severed from its distal attachment without injury to adjacent structures.

The dimensions of the cutting slot can be varied according to the width of fascia desired.

The fascia stripper has been given an extended trial at St. Luke's Hos-

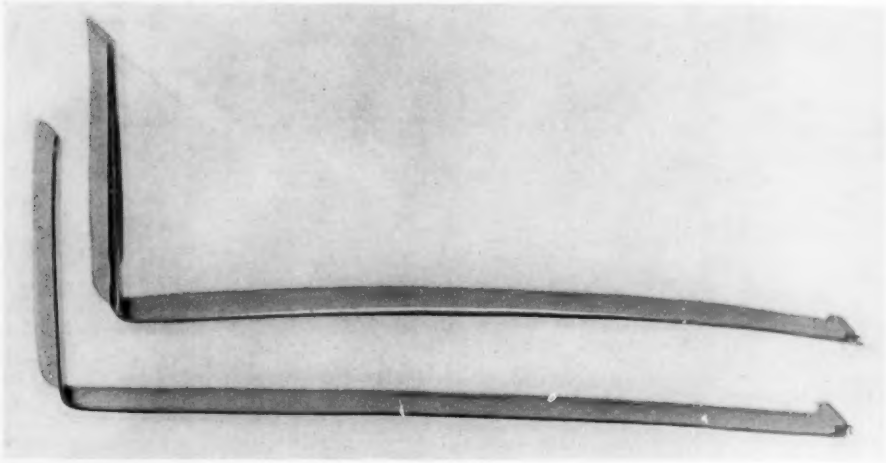


FIG. 5.—Photograph of instrument in experimental form.

pital, New York City, on the service of Dr. H. H. M. Lyle, and found to be most practical. It is simple in construction, easy of application, and produces an ideal strip of suture material.

JOHN T. BATE, M.D.,
Louisville, Ky.

BOOK REVIEW

GYNECOLOGICAL RÖNTGENOLOGY. BY JULIUS JARCHO, M.D. Quarto; cloth; 571 pages; 273 illustrations. Paul B. Hoeber, New York, 1931.

THE present volume is the thirteenth of the series of monographic atlases being edited by James T. Case, and represents the crystallization of many years' experience of the author in this department of diagnosis. Following the consideration of the general topographical anatomy of the female internal genitalia, the use of general röntgenological methods employed in gynecology and an historical review of the various means of röntgenological visualization of the uterus and tubes, the detailed description of perabdominal and per-uterine methods of inducing pneumoperitoneum are considered with their comparative usefulness, indications and dangers in administration. Therapeutically, the most notable use of this method is in the treatment of tuberculous peritonitis with intraperitoneal inflation with oxygen, the most striking being the results recorded by H. B. McCorkle. Certainly from a consideration of these, this method deserves a very essential and predominant place in the treatment of this condition.

The element of error in the diagnostic interpretation by this procedure is, however, very great and has been properly replaced in a large degree by uterosalpingography induced by the instillation of iodized oil into the uterine cavity as developed notably by Rubin. The combination of these two methods has in many instances distinct advantages which would not be possessed by using either one alone.

All of the various pathologic conditions found in the uterus and adnexa are considered and radiographs introduced depicting the findings. The question of female sterility naturally is given a predominant consideration. Ectopic pregnancy, flexions, versions, fibromata and inflammatory conditions are adequately and instructively presented.

The book is concluded by a chapter on radiation therapy in gynecology. The fifty pages devoted to this subject might possibly have better been omitted. Its relation to röntgenology and inclusion in the text of the already oversized volume is questionable. Its subject matter, however, is of very practical importance and interest, and details the author's technic of radium therapy with dosage and methods of filtration. The reviewer feels, however, the subject would be better included in a gynecological treatise.

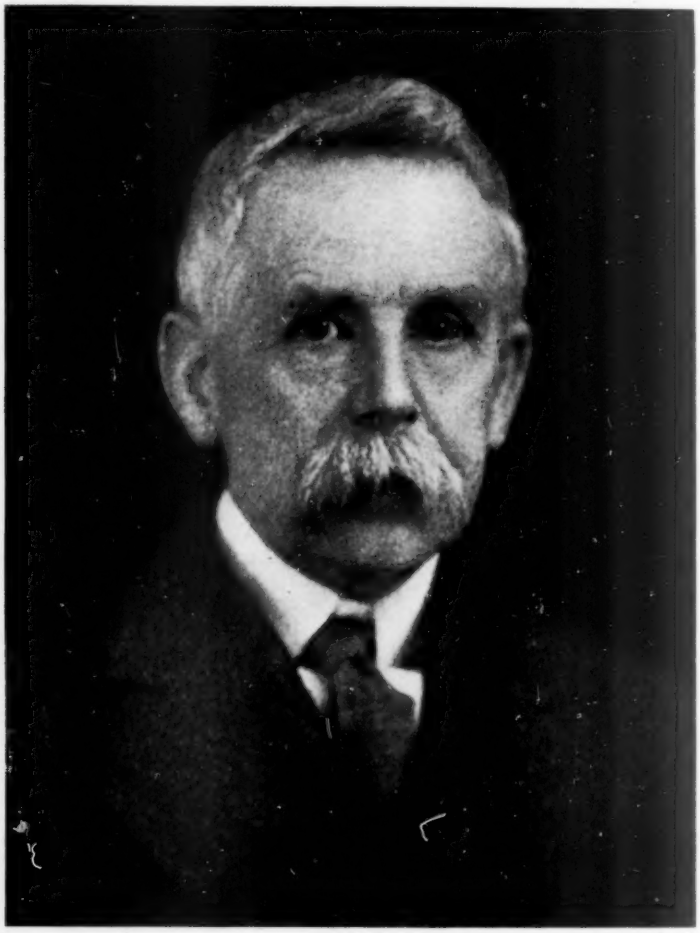
JAMES T. PILCHER, M.D.

MEMOIRS

NORMAN BRUCE CARSON, M.D.

1844–1931

ON THE morning of Monday, August 29, 1931, Dr. Norman Bruce Carson died. Born in Somerset, Pennsylvania, November 9, 1844, he had



NORMAN BRUCE CARSON, M.D.

passed his eighty-sixth year when his summons came. His last six months were a period of invalidism incident to his advanced age.

Doctor Carson was brought to St. Louis by his parents when he was three years old. He secured his early and his later University training in that city, graduating from the Arts and Science Department of the newly founded

Washington University. He prided himself on the fact that he was present at the first graduating exercises held by that institution.

Graduated from St. Louis Medical College in 1868, he then spent a year of post-graduate study in Vienna, during the Franco-Prussian War period, after which he returned to St. Louis to take up the practice of medicine. In 1870, he was given a place on the staff of Mullanphy Hospital, where he continued to work as assistant, then as operating surgeon, and finally as Chief of Staff, until his retirement from practice in 1920. His fifty-one years of active practice make one of the longest records credited to St. Louis practitioners.

He early became a member of the faculty of his Alma Mater, St. Louis Medical College, and when this institution merged with the Missouri Medical College, to form the medical department of Washington University, he became a member of the new faculty. He attained the rank of Professor of Surgery, and finally, resting from his teaching labors, in 1914, he was made Professor Emeritus. In 1925, Washington University conferred upon Doctor Carson the degree of D.Sc.

In 1888, he married Susan R. Glasgow, granddaughter of the first mayor of St. Louis.

He was a fellow of the American Surgical Association, serving as Vice President in 1903, fellow of the American Medical Association, and of the International Surgical Association. He had held the positions of Vice President of the Missouri State Medical Association, President of the St. Louis Surgical Society, and President of the St. Louis Medical Library Association.

Such is the chronological sequence of the life of Norman Bruce Carson, but it does not frame the man. Indeed, it scarcely connotes the colorful individual driven, for over half a century, by the two powerful impulses of surgical fervor and love of the out-of-doors. The solitudes of the American Rockies and the Canadian forests and streams furnished him the necessary respites from the dynamic surgical energy which placed him among the first to apply the antiseptic method in the middle West, and the first in St. Louis to remove the Gasserian ganglion for trifacial neuralgia. He was also a western pioneer in surgery of the abdomen and of the central and peripheral nervous systems.

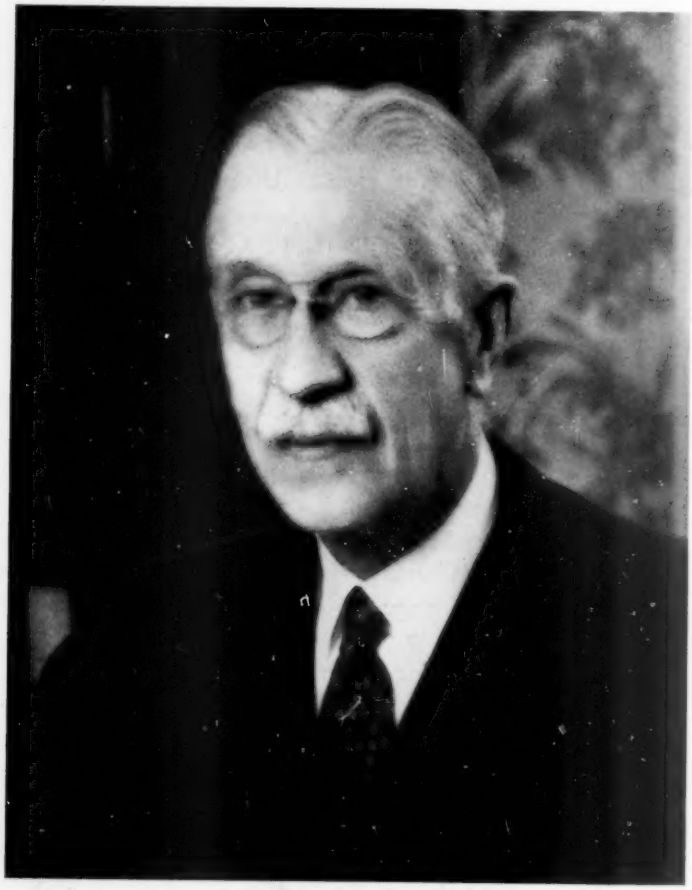
M. G. Seelig.

CHARLES N. DOWD, M.D.

1858–1931

To HAVE completed a useful life, respected and loved by his associates, a leader in his profession, a revered citizen, was the achievement of Dr. Charles N. Dowd.

Born in New Britain, Connecticut, April 29, 1858, Doctor Dowd passed his boyhood in Saratoga Springs, with which he was closely associated



CHARLES N. DOWD, M.D.

throughout life. He was graduated from Williams College in 1879 and then taught in his father's school for two years, running the school as a hotel during the summers. His determination to study medicine persisted, though there were real obstacles—financial stress, his father's opposition, and, finally, an infection of the eye which made it necessary to do all his studying for some months by having the subjects read to him.

He received his medical degree from the College of Physicians and Surgeons, New York, in 1886. After an interneship at Roosevelt Hospital, he practiced medicine successfully, being recommended by Dr. Francis Delafield to many families west of Central Park, where he developed a large practice. His interests, however, were always in surgery, with which he kept in touch by attending the New York Post-Graduate Medical School, first as a student and later as instructor in surgery.

Doctor Dowd gradually limited his activities to surgery and rapidly progressed in that field. He became Attending Surgeon to the General Memorial Hospital, a position which he held from 1894 to 1914. He was Attending Surgeon at St. Mary's Free Hospital for Children from 1905 to 1914, and at Roosevelt Hospital from 1914 to 1924. Later he became Consulting Surgeon to Roosevelt Hospital and St. Mary's Hospital in New York and the Saratoga Hospital. He was professor of clinical surgery at the College of Physicians and Surgeons. He received an honorary degree of Doctor of Science from Williams College in 1924. During the World War he was a Major in the Medical Corps, United States Army.

His connection with the General Memorial which treated a large number of cases of malignancy directed his early work toward this line. His early papers deal largely with this phase and he devised a plastic operation to cover the defect caused by the radical excision of epithelioma of the lip. At St. Mary's he had an opportunity to develop the surgery of infancy, and surgery of the neck was his great contribution from this service. Tuberculosis of the cervical lymph-nodes was a common disease of childhood at that time. It was poorly treated. He attacked this problem with characteristic thoroughness, studying etiology, operative procedure and late results. He demonstrated that surgical cure could be accomplished by a complete removal of the diseased nodes and devised incisions which would give the maximum exposure with the minimum of scarring. An important phase of the work was done in conjunction with Dr. William H. Park, which proved that the causative organism in the large percentage of the cases was the bacillus of bovine tuberculosis, and hence, that milk was a potent source of infection. In line with his neck surgery and also with a previous study of mesenteric cysts was his study of hygroma.

Doctor Dowd was a Fellow of the American College of Surgeons and of the American Surgical Association; a member of the New York Surgical Society, the New York Clinical Society, the Academy of Medicine, the American Medical Association and the West End Medical Society. He took an active and constructive part in the activities of these organizations.

Many of his contributions, which number over 130, will long exert influences on movements of the utmost importance; movements which he did not originate, but in which he was a pioneer.

He was an admirable executive, and was characterized by a methodical thoroughness and a meticulous attention to detail, and he expected the same of his subordinates. His opinions were formed always after mature deliberation. He had a most amiable and jovial disposition which brought him a

host of intimate friends. His associates had not only an admiration and respect for him, but also a deep affection.

Although he discontinued the active practice of medicine and surgery while still in good health, he continued to work and during the last few years had been of valuable assistance to the Saratoga Hospital, in which he was interested as a member of the Board of Managers and Consulting Surgeon.

His active mind led him into many channels of work. He was one of the founders of the Lake Avenue Association, Saratoga; he wrote a book describing the struggle for recognition of standard time, of which his father was the inventor; he frequently wrote articles on hospital work for the *Saratogian*; and only six or eight months before his death he evolved a transportation program for Saratoga Springs which was adopted by the planning commission and, if followed out, will be of inestimable advantage. And so, in his retirement from the practice of his profession, he did not retire from work, but led a busy, helpful life as he passed into the seventies.

After many years of distinguished medical and surgical service, Doctor Dowd died in Saratoga at the age of seventy-three on May 24, 1931. In his death the profession lost a leader, the community a good citizen, and those who were associated with him, a loyal friend.

EDITORIAL ADDRESS

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